THE THEORY OF THE MEASUREMENT OF THE INCOME OF TRADING ENTERPRISES

By

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Contents

Chapter		Page
	Part I	
I	Introduction	1
	The Definition of Income	2
	Statement of the Problem	10
	The Model	21
	Income Within the Model	27
	The Nature of the Enterprise	31
	The Timing of the Measurement	41
	Summary	44
II	Information and Communications	47
	Information	48
	Communications	59
	Summary	76
III	Measurement	78
	The Definitional Dispute	78
	General Propositions of Measurement	88
	Summary	104
IV	Measurement (continued)	109
	Conditions Attending the Operation of Measurement	109
	The Temporal Conditions of the Operation.	117
	Measurements, Predictions and Retrodictions	126

Contents

Chapter		Page
	Intensive versus Extensive Dimensions	135
	Objective Versus Subjective Measurements . .	144
V	The Theoretical Construct	164
	The Value Dimension	164
	The Problematic Situation	184
	Decision Theory of the Trader	186
	Decision Theory of Other Interested Receivers .	200
	Summary	220
VI	The Constructs Applied	222
	Information in the Model	222
	Measurement in the Model	241
	Summary of Part I	256
	Part II	
VII	Boulding's Constant	259
	Summary	283
VIII	The Fisher Tradition	286
	Discounting Under Conditions of Certainty . . .	296
	Valuation Under Uncertainty	314
IX	The Accounting Tradition	339
	The Fundamental Principle of Valuation	351
	The Fundamental Rule of Valuation	361

Contents

Chapter		Page
	Arguments for the Cost Rule	370
	Summary	412
X	Present Market	416
XI	The Assumptions Relaxed	422
	Perfect Market	422
	Stable Price Level	434
	Summary	457

CHAPTER I

INTRODUCTION

This study is the first step toward an attempt to develop a general theory of the measurement of enterprise income. We emphasize "measurement" because we will not be concerned with the definition of income; instead we will utilize a commonly accepted definition and reduce its implementation to a problem in metrics.

We call this a "first step" because we will limit our discussion to only one type of enterprise under severely simple conditions. Thus, our goal is modest:

> The development of a theory of the measurement of the income of trading enterprises.

The methodology is critical, analytical and eclectic. Different implementations of the accepted definition will be analyzed and criticized. Concepts from several disciplines will be used when they are germane to the problem. The underlying theme is pragmatism. The criteria flow from a consideration of the desired ends and, when the concepts permit, the development is rigorous.

The Definition of Income

For the purpose of this study we will use the definition presented by Hicks, Simons, Haig, Alexander, et al., as the fundamental basis for our discussion of the measurement of income.

Probably the most well-known of these definitions is Hicks':

> The purpose of income calculations in practical affairs is to give people an indication of the amount which they can consume without impoverishing themselves. Following out this idea, it would seem that we ought to define a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning. Thus, when a person saves, he plans to be better off in the future; when he lives beyond his income, he plans to be worse off. Remembering that the practical purpose of income is to serve as a guide for prudent conduct, I think it is fairly clear that this is what the central meaning must be.[1]

This definition is almost ideal for our purposes because of the explicit statement that income is to be a "guide for prudent conduct." We shall lay a considerable amount of emphasis upon income being a guide for prudent conduct, or, in the more modern and Americanized terminology, we shall emphasize that income should be useful for decision-making purposes. The decisions in

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[1] J. R. Hicks, Value and Capital, 2nd ed. (London: Oxford University Press, 1946), p. 172.

this paper, however, will be considerably broader than the general decision-theory type of problem. The literature on "Decision Theory" is aimed primarily at managerial profit maximization;[2] the decisions which we will be concerned with will not be so restricted. We will include the decisions of other people who are interested in the enterprise.

Hicks continues to discuss several approximations to the central meaning of his notion of income. Even though we have accepted Hicks' definition of income, we will not necessarily concur with his analysis of approximations to the central meaning of his income concept. For example, we will specifically quarrel with his statement that:

> ... ex post calculations of capital accumulation have their place in economic and statistical history; they are a useful measuring-rod for economic progress; but they are of no use to theoretical economists, who are trying to find out how the economic system works, because they have no significance for conduct.[3]

We will argue that an interpretation of the ex post calculation is a necessary datum for correct decisions and thus that it does have "significance for conduct."

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[2]Much of the current literature is devoted to variants on the maximum-profit theme. Some concentrate on minimizing costs with an assumed, often tacit, demand level. Others concentrate on time minimization with the implicit notion of the opportunity costs attached to time. We consider these, and other like developments, to be nothing more than special cases of profit maximization.

[3]Hicks, p. 179, second emphasis supplied. Hayek also denies

Taxation theory, with its emphasis on income tax, has of necessity been an area which has made the closest scrutiny of concepts of income. One of the earliest attempts in the United States was made by Professor Haig. He defines income as the

> ...increase or accretion in one's power to satisfy his wants in a given period in so far as that power consists of (a) money itself, or, (b) anything susceptible of valuation in terms of money.[4]

It is interesting to note the striking similarity between Haig's and Hicks' concepts of income, although it is quite clear that their basic assumptions about the use of that income were very dissimilar. Haig was working on a problem of getting an equitable method of levying income taxes; Hicks was concerned not with equity but with the practical conduct of affairs. Nevertheless, they came to the same conclusions as to the definition of income. This should be an important datum bearing on the prevailing notion that there is no single measurement of income that is proper for all purposes.[5] The notion of different income for different purposes is

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the usefulness of "income" in economic analysis. (See F. A. Hayek, Pure Theory of Capital (London, 1941), p. 336.)

[4]Robert Murray Haig, "The Concept of Income - Economic and Legal Aspects," reprinted in Musgrave and Shoup, American Economics Association Readings in the Economics of Taxation, IX (Homewood, Ill.: Irwin Press, 1959), p. 59.

[5]For example, Boulding states, "The concept of profit (income) will quite rightly differ depending upon the purpose for which we need it. The definition of profit for tax purposes, for instance, may differ considerably from the definition which is required for other forms of decision-making. What we need here

quite the vogue in this day and age, but, surprisingly enough, income definitions derived for these different purposes do not necessarily vary.

Professor Simons, writing contemporaneously with both Hicks and Haig,[6] defines income as follows:

> Personal income connotes, broadly, the exercise of control over the use of society's scarce resources. It has to do not with sensations, services, or goods but rather with rights which command prices (or to which prices may be imputed). Its calculation implies estimate (a) of the amount by which the value of a person's store of property rights would have increased, as between the beginning and end of the period, if he had consumed (destroyed) nothing, or (b) of the value of rights which he might have exercised in consumption without altering the value of his store of rights. In other words, it implies estimate of consumption and accumulation.[7]

Clearly, this definition is consistent with those of Hicks and Haig. A secondary purpose of Simon's statement is to reject Fisher's

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is not a single definition of profit applicable to all cases, but a spectrum of definitions, in which the relationship of the various concepts is reasonably clear and in which the definition is fitted to the purpose for which it is to be used." Kenneth E. Boulding, "Economics and Accounting: The Uncongenial Twins," Studies in Accounting Theory, eds., W. T. Baxter and S. Davidson (Homewood, Ill.: Richard D. Irwin, Inc., 1962), p. 45.

[6]1938-39 seems to have been a vintage year for income definition. Unfortunately, the edicts of these authors have either been forgotten or deliberately ignored.

[7]Henry C. Simons, Personal Income Taxation (Chicago: University of Chicago Press, 1938), p. 49.

concept of income. The phrase "sensations, services or goods" is obviously, albeit tacitly, a quarrel with Fisher.

This quarrel (and others about Fisher) is not relevant to this study. This paper has been restricted to the consideration of enterprise income while Fisher's analysis is of personal income. Fisher's concept is almost exclusively psychic and since, by definition, an enterprise can have no psyche, both the problems and the method of approach are different. Fisher disqualifies himself in the consideration of enterprise income by writing:

> It is interesting to observe that a corporation as such can have no net income. Since a corporation is a fictitious, not a real, person, each of its items without exception is doubly entered. Its stockholders may get income from it, but the corporation itself, considered as a separate person apart from these stockholders, receives none.[8]

If we accepted Fisher's notion this study would end at this point, and therefore it is clear that we must disagree in order to continue. The point of disagreement, however, is at the premise, not in the analysis. Fisher assumes that a psychic experience must occur before there is "income." We make no such assumption in our definition, and appeal to the linguistic fact that something called "income" has been utilized for many years, both in common parlance and scientific inquiry, as a measure of the "success" of an enterprise.

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[8]Irving Fisher, The Theory of Interest (New York: MacMillan, 1930), p. 23. For a full explanation of the "double entry" see

Even Fisher's disciples disagree with him on this issue. Lindahl, who has probably done more than any other person in advancing Fisher's thesis, takes him to task:

> Irving Fisher's analysis is carried out in a masterly fashion, but all his attempts to demonstrate that this concept of income is the usual one and that it is the only logical one, must be considered unsatisfactory. In neither popular nor scientific terminology are income and consumption equated....[9]

Lindahl, after the basic disagreement has been stated, proceeds to develop a theory of income based upon Fisher's analysis, particularly upon the concept of ertrag or yield. However, Lindahl's theory is concerned with the valuation of wealth, not with a different definition of income. He is in agreement with the definitions presented above; his quarrel is with the method of valuation. He continues:

> ...income is generally taken to include saving (either positive or negative), and the crux of the matter is to decide just what this saving may be taken to cover.[10]

That is, the "crux" is capital valuation, not the definition.

In a more modern context, Professor Alexander writes:

> A year's income is, fundamentally, the amount of wealth that a person, real or

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Irving Fisher, The Nature of Capital and Income (New York: MacMillan Co., 1906), especially pp. 159-164.

[9]Erik Lindahl, "The Concept of Income" in Economic Essays in Honor of Gustav Cassel (London, 1933), p. 400.

[10]Ibid.

> corporate, can dispose of over the course of the year and remain as well off at the end of the year as at the beginning.[11]

Again, the definition is equivalent to the several presented above, except for the minor change of the time period from one week to one year. As Alexander states:

> Another set of problems, which concern the question of what is meant by "as well off at the end of the year as at the beginning" is the principal subject of the present monograph.[12]

Thus Alexander is concerning himself with the problem of valuation at two time periods. His conclusion is essentially the same as Boulding's, that "...many variant concepts [of income] can be conceived, each of which has certain advantages for a particular purpose."[13]

The above definitions of income are all by economists. Much ado has been made in recent years about the difference between the economists' and the accountants' concept of income. The quarrel is semantic. Accountants also accept the definition; their method of valuation is the variant.

A reference to the basic accounting equation--assets equal equities--proves the point. Accountants array the assets and

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[11]Sidney S. Alexander, "Income Measurement in a Dynamic Economy," Studies in Accounting Theory, eds., W. T. Baxter and S. Davison, revised by David Solomons (Homewood, Ill.: Richard D. Irwin Press, 1962), p. 127.

[12]Ibid.

[13]Ibid.

liabilities of a given enterprise at a point in time and "value"[14] them. At a subsequent point in time, usually a year, the accountants repeat the process. The difference between the proprietorship or owner's equity at these two points, properly adjusted for investment and dis-investment, is equal to the owner's income for that period. Almost every basic textbook in accounting has a problem which can be stated mathematically as:

$$A_1 - L_1 = P_1;\ A_2 - L_2 = P_2;\ P_2 - P_1 = \pi$$

π is equal to the income of the enterprise for the period (t_1 to t_2) if there had been no investment or dis-investment. Montgomery makes this explicit by remarking:

> If an absolutely accurate balance sheet could be prepared at the beginning and the end of a period, the difference would constitute the net profits or the net loss for the term.[15]

More recently and more directly Gordon has stated:

> ...we all agree with Hicks who defined "a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of

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[14] There is a quarrel whether the accountant "values" assets or does something else. The entire rationale of "unexpired costs" has been attacked and the debate has been over whether "costs" are "values." Simons has taken the position that the accountant does not value because there exist different costs for the same goods. For a more complete discussion, see infra.

[15] Robert H. Montgomery, Auditing (New York: Ronald Press, 1916), p. 206. He rejects the method, however, because "the valuation and revaluation of capital assets involves too much speculation..." (p. 206).

> the week as at the beginning." Disagreement arises as to the operational meaning to be given to the phrase "as well off."[16]

In summary, the definition or concept of income as being "the difference between wealth at two periods of time plus consumption" is agreed upon by almost all writers. We will utilize this definition in this study as a fundamental premise.

Statement of the Problem

The above section pointed out the concurrence of opinion about the definition or concept of income, among economists as well as between economists and accountants. The problem then is not with the definition of income, but with the application of the income concept in a specific instance. The basic disagreement centers around the phrase "as well off" in the definition. There are at least four[17] different approaches to the measurement of how "well off" a person or enterprise is.

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[16]Myron J. Gordon, "Scope and Method of Theory in Research in the Measurement of Income and Wealth," Accounting Review, XXXV, No. 4 (October 1960), p. 606, emphasis supplied.

[17]There are almost as many ways of classifying income concepts as there are writers on the subject. For example, Hicks lists three (Hicks, pp. 171-177). Hansen lists three different concepts of the Fisher Tradition and refers to a fourth presented by Kristenson (Palle Hansen, The Accounting Concept of Profit, Amsterdam: North-Holland Publishing Co., 1962, p. 21), Kerr lists three which are sub-classifications of the Accounting Tradition (Jean Kerr, "Three Concepts of Business Income," in Davidson, Green, Horngren and Sorter, An Income Approach to Accounting Theory,

The Fisher Tradition[18]

> In the absence of dividend payments and new contributions by stockholders, income is measured at the end of the period by adding up the discounted values of all net receipts which the managers then expect to earn on the firm's existing net assets and subtracting from this subjective value a similar computation made at the beginning of the period.... The development of this concept, stated here in extremely simple terms, has been largely the work of Erik Lindahl, Studies in the Theory of Money and Capital, ...[19]

The key word in the above quotation is "expect." In the Fisher tradition, expectations about the future are the basis of the measurement of income.

Since the future, by definition, cannot be measured, what we are measuring under this tradition is the owner's and/or manager's expectations or feelings about the future. In the case

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Englewood Cliffs, N. J.: Prentice-Hall, 1964, pp. 40-48), Wueller discusses a great many without ever bothering to classify them except in the most general terms (P. H. Wueller, "Concepts of Taxable Income," Political Science Quarterly, Part I, LII (March, 1938), 83-110, Part II, LIII (December 1938), 577-583, Part III, LIV (December 1939), 555-576). In brief, this classification is not natural or infallible, it is only convenient. However, the attempt has been to state each one broadly enough to include all the extant concepts.

[18]Although, as noted above, Fisher disqualified himself from the measurement of enterprise income, Lindahl, Cassell, Hansen, and others have developed a concept of income which springs directly from Fisher's ertrag. Thus, we classify this concept as being in "The Fisher Tradition."

[19]E. O. Edwards and P. W. Bell, The Theory and Measurement of Business Income (Los Angeles: University of California Press, 1961), pp. 24-25, emphasis supplied.

of personal income these feelings are part of the psychic benefits received by the individual. In the case of enterprise income, since the enterprise cannot have feelings, what we are measuring are the feelings or expectations of the managers. Thus, the measurement of well-offness is dependent upon management's prognostication of what the future holds.

Criticism of this concept usually falls into two categories: (1) it is subjective, and (2) the future is uncertain.

The first criticism--subjectivity--appears to be the crucial one for most writers. The concept is usually rejected out of hand because it is subjective. An extended discussion of subjectivity versus objectivity would be much beyond the scope of this paper and would lead us into a philosophical discussion that is as yet unresolved.[20] Suffice it to say at this point that these "subjective"

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[20]If what is meant by subjectivity is the antonym of objectivity which is defined as "being, or regarded as being, independent of the mind; real; actual." (From Webster's New World Dictionary of the American Language), then the so-called "objective" method of measuring assets by their cost would be subject to the same criticism. That is, the determination of costs and their amortization are no more "free from the mind" than is the subjectivity of the expectations of the managers. If what is meant by subjectivity here is that it is not verifiable, then "descriptive propositions are statements about fact, and are theoretically verifiable by any competent observer as either true, false, or having a certain degree of probability. Normative propositions are assertions of value: their truth or falsity may therefore legitimately vary for different individuals." (Philip Wheelwright, A Critical Introduction to Ethics, revised edition, New York: Odyssey Press, 1949, p. 49). Since the valuation by expectations of the owners appears to be descriptive rather than normative--what ought to be--it would appear that they would be equally

valuations must be made, as will be demonstrated below, and, if they are to be rejected for the purpose of income determination, they must be rejected on grounds other than their subjectivity.

The second criticism--uncertainty--is not directed against the concept but, instead, that certainty does not conform to reality. That is, most writers seem to take the position that if the future were certain there would be no problem of income determination under the Fisher tradition. For example, Moonitz goes through "a valuation experiment" in which he assumes complete certainty of the future. He concludes by saying:

> How much of the data shown for each year can be reflected in a matching of cost and revenue under the practical difficulties with which we are forced to contend under ordinary circumstances? That these difficulties stem mainly from the fact that we cannot know what the events will be during the entire future life of an enterprise is now apparent.[21]

Moonitz implies that if the future were known with certainty there would be at least fewer, and perhaps no, problems of income determination. Such a sanguine view of this method under certainty is not taken by those people who are directly working with the

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verifiable as any other method of valuation. See, for example, Ray Lepley, Verifiability of Value, especially Chapter 2, "The Nature of Value Verification." We will discuss the problem in a little more detail in connection with metrics. See infra.

[21]Maurice Moonitz and Louis H. Jordan, Accounting: An Analysis of its Problems, revised edition, (New York: Holt, Rinehard and Winston, 1963), I, p. 135.

development of this theory. Hansen notes at least four possibilities for adjusting the capital. He states:

> The profit according to method (1) conforms closely to the concept of gains and is therefore encumbered with the theoretical defects of this concept of profit (see above).
>
> Profit according to method (2) corresponds to the above-mentioned concept of adjusted anticipated capital interest. Consequently, the sum of the period-profits will not be equal to the ideal profit.[22]

Note that these difficulties in Hansen's determination of income would not disappear even if the future were known with certainty. We will deal with the problem of uncertainty below from a different approach.

The Accounting Tradition

"In keeping with the principle that accounting is primarily based on cost, ..."[23] this approach appears to be antithetical to that presented above. That is, the Fisher Tradition was concerned with future expectations while accounting, based on cost, is concerned with past acts. The fact that accounting is concerned with the past is one major source of criticism. If we accept Jevon's dictum that "in commerce bygones are bygones," this criticism

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[22]Hansen, p. 29.

[23]Accounting Research and Terminology Bulletins, final edition (New York: American Institute of Certified Public Accountants, 1961), p. 28.

seems to have validity. However, if there are other purposes for the measurement of income, e.g., the administration of working capital,[24] then the criticism can be met by stating a variance in purposes of the measurement.

In addition, accounting is sometimes criticized because it is not a valuation method.[25] This depends upon the definition of "valuation." Moonitz takes the view that the problem is one of valuation and that cost is one method of expressing value and, further, it is the desirable method.

> Accounting literature of the past quarter-century is replete with discussions of a supposed conflict between cost and value as a leading postulate in accounting. The preceding discussion has shown that there can be no conflict because the two concepts are not co-ordinate. The concept of value is the major one; cost is one method or

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[24]Devine makes the administration of working capital an explicit objective of income. That is, income should have something to do with the ability to pay dividends. See Carl Thomas Devine, "Loss Recognition," from Accounting Research, VI (October 1955), 310-320, reprinted in Davidson, Green, Horngren and Sorter, An Income Approach to Accounting Theory (Englewood Cliffs, N.J.: Prentice-Hall, 1964), p. 163.

If one pursues Devine's concept he finds himself in the position of arguing for the cash basis of income measurement. It may even further entail the cash position of the enterprise because of the inability to pay dividends from assets that were once cash.

[25]"One might say that he [accountants] often eschews valuation entirely. At least, one finds difficulty in the idea that an inventory is being "valued" when different parts of an inventory of identical goods are priced differently--as is approved practice." (Simons, Personal Income Taxation, p. 80, footnote 54.)

> formula for expressing value. In many cases, cost is probably the most useful formula to follow, but it is still only one procedure. In brief, the "conflict" raises a false issue.[26]

Simon objects to calling "cost" valuation because identical items receive different unit values. The lack of comparability within the firm is Simon's concern. Accountants are also concerned with identical items receiving different values but their emphasis is on inter-firm comparability. The deviation in the value of identical items is the basis of the continuing argument over uniformity of accounting principles. If the principles were uniform, the values would be identical. For example, Mr. Bows criticizes the lack of uniformity in current accounting practice by positing two identical firms and noting a value deviation of several hundred per cent.[27]

The lack of uniformity in accounting principles and its different valuations for identical assets should raise some questions about "objectivity" in accounting. For example, Mr. Alexander states:

> Another very powerful factor operating on the development of accounting methods has been the attempt to minimize the accountant's responsibility for the human judgments which must be made in passing from a consideration of the accounts to the conduct of business affairs. This desire to avoid responsibility

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[26]Moonitz and Jordan, I, p. 169.

[27]Albert J. Bows, "The Urgent Need for Accounting Reform," The National Association of Accountants Bulletin (September 1960), p. 43.

> has led accountants to set up two requirements for sound accounting that somewhat limit the choice of methods. These are the requirements of objectivity and conservatism.[28]

Again, without going beyond the scope of this paper into a philosophical discussion of objectivity versus subjectivity, it would appear reasonable to cast a doubt upon the "objectivity" of a method that allows such deviations in the results. If one means by objectivity the verifiability, then cost may be more readily verified than some subjective value, but it is certainly not "objective."

This point is so often misunderstood that it deserves repetition. Most writers outside the field of accounting consider that the word "cost" closes the discussion of objectivity. Nothing could be further from the truth. Most of the writing about accounting could be classified as explaining what accountants mean by cost and how it is determined. To state the proposition of "cost" without further explanation is meaningless even to the accountant. Voluminous tomes have been written concerning the definition of "cost." Paton has made the matter explicit by criticizing his colleagues as some of the worst offenders in considering cost objective. He writes:

> Accountants are supposed to be thoroughly familiar with this situation [difficulty of determining cost] and hence the faith that some of them seem to have in the objectivity

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[28] Alexander, p. 128, emphasis supplied.

> and reliability of complied cost data is something at which to marvel.[29]

Regardless of difficulties of this kind we take the position that the assignation of dollar amounts to assets is "valuation." Obviously then, accountants value under our definition. However, the point is not central to the analysis. If one wants to call what the accountant does non-valuation, it will not affect the conclusion of this study.

Market Value

The notion that present market values are the correct method of valuation does not have such a body of theory supporting it as the two previous notions. It is true, that, for example, Alexander states:

> It is probably obvious to most people that market value is the appropriate measure of well-being associated with each item of wealth in a man's possession.[30]

Nevertheless, Alexander does not support this view in the rest of his theoretical analysis. His conclusion, as we stated above, is that there can be different income for different purposes. Several other writers take a similar position,[31] but none develop a body

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[29]William A. Paton and William A. Paton, Jr., Asset Accounting (New York: Macmillan Co., 1952), p. 54.

[30]Alexander, p. 137.

[31]For example, Joel Dean, "Measurement of Real Economic Earnings of a Machine Manufacturer," Accounting Review, XXIX, (April 1954), p. 257.

of theory about it with the single exception of Edwards and Bell.[32]

Certain accountants also take the position that present market value is a proper method of valuation. MacNeal, in Truth in Accounting, set forth this position in great detail in the 1930's. More recently, the so-called revolution in accounting has been taking the same position. For example, a recent article takes the position that valuation of current assets at cost is not only "traditional" but also "treacherous."[33]

The primary criticism against current market value is its lack of objectivity. This stems mainly from accounting circles who, subject to Mr. Paton's criticism above, feel that cost is completely objective.

A second criticism of present market value is approached by the taxation theorists as the distinction between the "ability to pay" and the "capacity to pay," that is, the "separation problem." The argument runs that income is not "earned" until it is separated by receipt of cash.[34] This is very similar to Devine's position on

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[32]E. O. Edwards and P. W. Bell, The Theory and Measurement of Business Income (Los Angeles: University of California Press, 1961). However, their interpretation of market value is replacement cost. Also, they utilize an entirely different methodology and thus their analysis is not pertinent.

[33]Robert T. Sprous, "Historical Costsand Current Assets--Traditional and Treacherous," Accounting Review, XXXVIII (October 1963), pp. 687-695.

[34]The architect of this view, which is the basis of modern accounting, is Professor Seligman's argument before the Supreme Court (Eisner vs. Macomber 252 U. S. 289, 1919) that stock

the administration of working capital. However, accountants are usually concerned about the capacity to pay dividends, whereas capacity in this context is concerned with the payment of taxes. Otherwise they seem to be identical notions. We will discuss this below.

Boulding's Constant

Professor Boulding seems to be in a class by himself in his suggestion for the use of a constant. While there are many other writers in economics and accounting who would agree with the basic proposition that income is essentially unmeasurable in any completely unassailable fashion, there are a few who would go so far as to say that it is so arbitrary that a constant might well be used. Because of the arbitrary element, Boulding suggests a constant. He writes:

> All valuation thus seems to possess a certain unavoidable arbitrary element, as long as the asset structure remains heterogeneous....A possible method of escape from this dilemma is to perform all valuations at a constant valuation ratio, independent of the market price.[35]

Boulding is alone in this suggestion and there is no extant criticism of his method. We will deal with it below.

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dividends are not taxable because they are not "separated." "Separation" here means clearly the receipt of cash, i.e., the "cash basis accounting."

[35]Kenneth E. Boulding, A Reconstruction of Economics (New York: John Wiley and Sons, Inc., 1950), p. 45.

Summary

Although there is general agreement on the definition of income, there are four alternative methods of determining "well-offness" which yield widely varying results. Each of these methods has supporters and detractors, advantages and disadvantages. Several authors take the position that the purpose of the income measurement will determine which of the methods should be used and that more than one method should be used concurrently.

We will examine the alternative methods below and attempt to set forth generalized criteria that will allow us to select one (or more) of the methods as better than the others.

The Model

The model used in the analysis is essentially the same as the one presented by Boulding.[36] A cursory review of the necessary assumptions and conditions will be presented below. The interested reader will find a more complete description by Boulding, especially in A Reconstruction of Economics.

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[36]Kenneth E. Boulding, Economic Analysis, 3rd ed. (New York: Harper and Bros., 1955), p. 277 et passim.; Kenneth E. Boulding, A Reconstruction of Economics (New York: John Wiley and Sons, Inc., 1950), pp. 39 ff; Kenneth E. Boulding, "Economics and Accounting: The Uncongenial Twins," Studies in Accounting Theory, eds., W. T. Baxter and S. Davidson (Homewood, Ill.; Richard D. Irwin, Inc., 1962), pp. 44-55.

In Figure 1 the model is presented in its entirety. "Dollars" or "money" are measured on the y-axis and "wheat" on the x-axis. The simplicity of using only two commodities, although money is a "general" commodity, allows us to picture the "trader"[37] in all possible positions and also to trace the path from one position to the next. This is the value of the model. In a simple two-dimensional diagram the present position, as well as all past positions and all possible future positions are presented visually, and cast the problem of valuation in strong relief.[38]

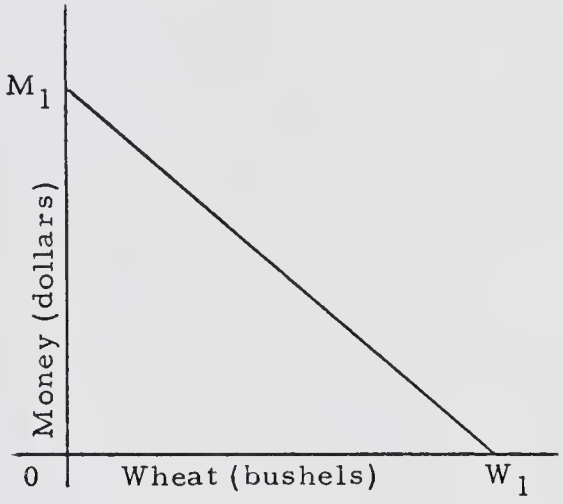

Figure 1

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[37]Boulding refers to this model as a "pure marketer." "Trader" has been selected here to differentiate between two kinds of "marketers"--as opposed to "producer." In a later study an inventory holding marketer--"merchandiser"--will be considered.

[38]It is also possible, as Boulding shows, to present "negative wheat" and "negative money," i.e., short selling and debt, by utilizing two other quadrants. However, the existence of debt or short contracts, while real and interesting problems for other purposes, are excluded from consideration in this study because they are only tangential to the central problem.

The Transformation Coefficient

The line in Figure 1 is a "transformation coefficient" or the market price that exists at the present moment. It defines all the trader's opportunities in this market. The trader, at the present moment, can move to any point on this line from M_1 to W_1 in the ratio implied by the slope of the curve. Note that the trader cannot move to any point away from the curve and remain in the market. This is the difference between this transformation coefficient and the production-transformation function more generally used in economics.[39]

The model further simplifies considerations by placing severe restrictions upon the activities of the trader. There are only two courses of action open to the trader: He can (1) exchange, or (2) hold (the negative of, or refusal to, exchange). If he is at some point away from the axes, he can move in two directions: toward the y-axis (money) or toward the x-axis (wheat). Within the model there is no provision for additions (savings, investment) or deductions (consumption or shifting investments). Moreover, the linearity of the curve implies, and we make explicit, that the trader

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[39]The production-transformation function allows for movements to points below the curve (toward the origin) by underemployment of the resources. Under- or un-employment concepts are not useful in this context of pure exchange and the curve defines all the possibilities. If commodities are removed or destroyed it simply moves the curve back toward the origin and changes all the opportunities by the same amount.

is operating in a perfect market where his decisions do not affect either the present or future transformation coefficients.[40] Thus, an exhaustive statement of the trader's alternatives within this market is that he may (1) hold, or (2) exchange along an externally determined and completely defined route.

The Valuation Coefficient

In order to determine the "net worth" or "total value of assets"[41] when heterogeneous assets[42] are held, it is necessary to express one asset in terms of the other. That is, it is necessary to measure one asset with the other[43] in order to sum the two. In Figure 2 the trader has moved along a transformation curve (not shown) to point P_1, and we wish to calculate the value of his net worth. In order to do so we will draw off a valuation curve (arbitrary in this case) V_m to V_w.[44]

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[40]We mean by perfect market simply that the changes in price are exogenous. The other requirements for a perfect market, such as perfect knowledge, are not germane so long as the trader cannot affect the present or future price by his actions.

[41]The two terms are equal magnitudes since we have excluded debt.

[42]As we will see below, heterogeneity is not the cause of the problem, but it is usually stated in this context.

[43]Of course a third "measuring" asset could be used, but this would not add anything to the analysis; it would simply require a third dimension on the graph.

[44]We also assume the valuation curve to be linear. If it is not, there are serious difficulties from the theory of measurement. For example, the units are not additive.

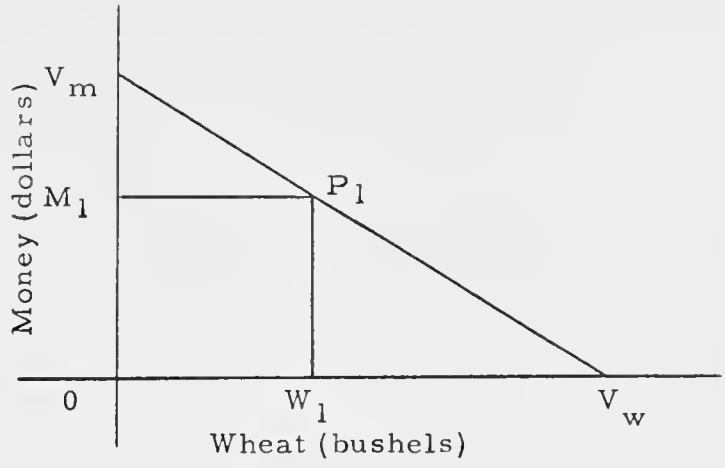

Figure 2

The value of the enterprise can now be expressed as OV_m in money or as OV_w in wheat. This is made up of two parts: OW_1, amount of wheat, multiplied by the slope of the curve, and the product added to OM_1 (multiplied by unity since money is the measuring agent in this case) to arrive at OV_m, and the same process for OV_w if wheat were selected as the valuing agent.

The problem--and it is the prime problem of this study--is that the "proper" or "correct" valuation coefficient is not immediately apparent. Indeed, it is the subject of much debate and controversy.[45]

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[45]We can agree with Boulding when he says:

> Without knowing a set of valuation coefficients, therefore, we cannot tell whether the point P is "larger" or "smaller" than P_1. ("Twins," p. 48)

and:

> If, then, we are to say whether <u>any</u> given change represents

In a previous section we presented four competing methods of valuation. The Fisher Tradition; the Accounting Tradition; Present Market value; and Boulding's Constant. In terms of the model these are simply different valuation coefficients. Note also that three of the four valuation coefficients are, have been, or are expected to be, transformation coefficients. The Fisher Tradition valuation coefficient is an expected (future) transformation

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> a gain or a loss, and even more if we are to be able to measure the gain or loss, we must have a system of valuation....(Reconstruction, p. 43, emphasis supplied.)

However, when he says:

> It is clear that, as the various transformations are made and the speculator traces out the path $P_0P_1...P_7$, he reaches certain positions which are quite obviously superior to his starting point....P_5 is unquestionably a preferable position to P_0, for it represents a greater quantity of both assets than does P_0. (Idem.)

it is neither clear, obvious, or unquestioned, that simply because a position represents a greater quantity of both assets that it should also represent a preferable position.

A preferred position requires the positing of certain assumptions about the motive of the trader or his enterprise. It may be that the trader is trying to maximize something, but it is not clear that the maximization vector is necessarily in the direction of a point between the axes. The vector may be along one axis or nearer one axis than the other. Also, it is difficult to speak of a superior position without some knowledge of the trader's expectations, even if we have identified the maximization vector.

If Boulding is speaking only of a greater quantity representing a greater value, then we must agree, if the valuing agent has a constant valuation coefficient. Obviously then, a greater quantity of the valuing agent would yield a greater value so long as the other commodity's value was not less than zero.

coefficient. The Accounting Tradition is a past (entry, cost) transformation coefficient and the present market value is the existing (present) transformation coefficient.

Recognizing this fact we could classify our alternatives as

(1) Using a valuation coefficient that is independent of transformation coefficients, or

(2) Using a valuation coefficient that is either (a) past (b) present or (c) expected transformation coefficient.

Other Assumptions in the Model

The valuing agent (the commodity selected to express the total value) will be assumed to have a constant valuation coefficient (unity). This assumption implies that if money is selected as the valuing agent, a stable price level is assumed. We will later relax the assumption of a stable price level. In addition, we will assume that there is no problem in ascertaining the physical quantities involved.

Income Within the Model

In the analysis of the model we will use the generally accepted definition of income, viz., income is the difference between wealth at two periods of time plus consumption (dividends for an enterprise). Specifically, we will value the enterprise's assets (equal to net worth) at two periods and take the difference.

The limitation of "enterprise income" avoids the problem of utility measurement since, by definition, an enterprise can have no wants to be satisfied and hence no "utility." If the trader's utility is relevant to the question of enterprise income, we will assume, along with Pigou,[46] that the utility varies in the same direction as the wealth. However, only the "wealth" (value of assets of the enterprise) will be measured; any adjustment necessary because of the declining marginal utility of wealth is outside the scope of enterprise income.

Income from a Complete Exchange

If at any time the enterprise has all of its assets in the form of the valuing agent, the exchange will be defined as "complete." Following the assumption above--the valuing agent has a valuation coefficient of unity--the value of the enterprise is unequivocal when the exchange is complete. Hence, it follows that the measurement of the income is unequivocal between two instants when the exchange is complete at both instants.

In Figure 3 the trader holds W_1 quantity of wheat (the valuing agent in this example) at instant t_1 and W_2 quantity at t_2. The income of the enterprise is W_2 minus W_1, for the time t_1 to t_2.

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[46]Pigou states it in different terms: "When we have ascertained the effect of any cause on economic welfare, we may...regard this effect as probably equivalent in direction, though not in magnitude, to the effect on total welfare..." A. C. Pigou, The Economics of Welfare, 4th ed. (London: Macmillan and Co., Ltd., 1950), p. 20.

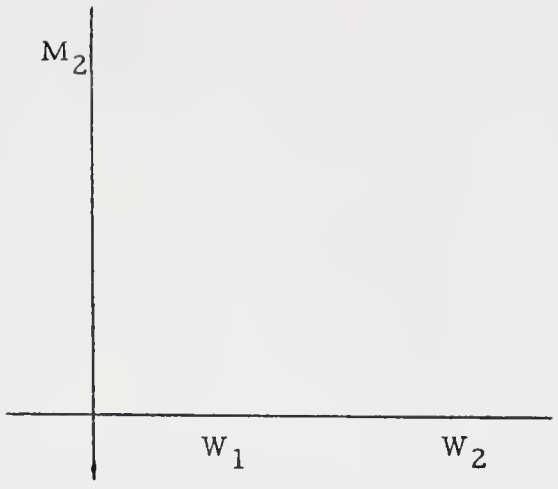

Figure 3

There is no problem of valuation coefficients when the exchange is complete. Note, however, that if the enterprise were at M_2 at t_2 the problem of valuation coefficient selection is met although the assets held at t_2 are homogeneous.

This is a slight disagreement with Boulding. He states that the problem arises only when heterogeneous assets are held. This may mean heterogeneous assets over time, i.e., an incomplete exchange, and if so, we agree. However, it is clear that the assets may be homogeneous at one instant in time without solving the problem of valuation. Also, if the asset is held in homogeneous form over time and is not in the form of valuing agent, the problem would still arise. The point is that the asset must be homogeneous in the form of the valuing agent instantaneously and intertemporally before the measurement can be unequivocal.

Wheat was selected as the valuing agent in the above example and we arrived at an unequivocal measure. However, it is

obvious that the valuing agent needs to be more than a chance selection if the income is to be of maximum usefulness. The selection of either commodity as the valuing agent is not dictated by the model; exogeneous criteria must be employed. The selection will be made below.

Income from an Incomplete Exchange

If the enterprise holds any portion of its total assets in a form other than the valuing agent, the exchange is defined as "incomplete." In this case, and only in this case, the problem of valuing one commodity in terms of the other arises. Thus, the principal problem of this essay may be stated simply as the problem of valuing assets under the condition of an incomplete exchange.

It should again be noted that the problem is not one of valuing heterogeneous assets. The valuation coefficient of the valuing agent has been assumed to be unity, and hence there is no difficulty in valuation. The problem is one of valuing the other asset(s) in terms of the valuing agent.

This entire problem could be avoided by simply waiting until the "incomplete" exchange became "complete." Thus, the trivial solution to the problem of income measurement is evident: Wait until the exchange is complete. The problem arises only when the measurement is desired prior to the completion of the exchange. An examination of this desire--the impetus of the problem--is beyond the model and requires specific criteria. This will be discussed below.

Summary

A two-commodity trader model has been presented to facilitate discussion of the problems of income measurement. Income was defined as the difference between wealth at two instants in time and the problem was stated as being the selection of a valuation coefficient.

We noted that the problem arose only when the measurement was desired prior to the completion of the exchange. Two subsidiary problems were pointed out:

1. The selection of the valuing agent.
2. The impetus of the desire for the measurement.

The Nature of the Enterprise

In the above section we identified two separate, although related, problems that arise because of considerations outside the model. The purpose of this section is to resolve these problems. However, prior to such a resolution, a general discussion of the nature of the enterprise and the trader is necessary in order to make the assumptions and the criteria which follow from those assumptions explicit.

The Motive Force of the Enterprise

It is clear that the "enterprise," being an inert thing and an abstraction, can have no motive force. Any motivation imputed to the enterprise, therefore, must spring, ultimately, from humans.

The question of what motivates humans (individuals or groups) is one that is the subject of much disagreement and debate. The "economic man" has long been discredited and utility theory subjected to bitter attack concurrent with elaborate refinements. In light of this, the wonder of utility theory is not its fidelity with reality, but rather its tenacity and resiliance. Since Jevons'[47] original charge that economics must be grounded in utility, the concept has been inescapable.

The author, aware of the attacks and personally having some reservations about its adequacy, assumes that the maximand of humans, or groups of humans, is utility.

Moreover, this assumption is not restricted to the narrow notion that utility can arise only by consumption. This, in the author's opinion, is the basic flaw in the otherwise brilliant works of Fisher. It appears reasonable to assume that a man can gain satisfaction from the mere fact of <u>being able to consume</u> rather than the actual act of consumption. The act of consumption is generally agreed to be want-satisfying. The problem is one of timing: Does the ability to satisfy a future want (future consumption) produce the satisfaction of a present want? Fisher's answer is no; any delay in consumption must be compensated for by future

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[47]Or, as Schumpeter would have us believe, since Aristotle. Joseph A. Schumpeter in Elizabeth Boody Schumpeter, ed., <u>History of Economic Analysis</u> (New York: Oxford University Press, 1954), p. 1054.

consumption that is greater than the present consumption foregone. The author's answer is yes, because of the declining utility of present consumption, a delay in consumption may increase the totality of the satisfactions.

Certainly in the reductio ad absurdum case of zero consumption in the future with 100 per cent consumption now, there would be greater utility by waiting. It may be true that the consumers' "telescopic faculty is defective,"[48] but this does not negate the fact that if a consumer decides to wait, he will increase his utility. The command that he has of the future will avoid the disutility of anxiety in addition to the power, prestige and security (and accompanying utility thereof) that is accorded him because of that command. Consideration of these factors can build a strong case for the willingness of a rational consumer to pay negative interest in order to insure future consumption. (This is exactly the situation that the Swiss Banks find themselves in today. They charge their depositors, instead of paying, interest.) Thus, the mere fact of being able to command goods and services, regardless of whether the command is ever exercised by consumption, is productive of utility.[49]

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[48]Pigou, p. 25.

[49]Obviously, this cursory statement is not intended to refute Fisher. The intention is simply to make clear the assumptions of this study by using Fisher as a relief.

Thus, we assume that there are two (relevant) sources of utility: (1) consumption and (2) command over goods.

Selection of the Valuing Agent

Undoubtedly, it is apparent that money will be selected as the valuing agent. Nevertheless, we consider it imperative that we go through the selection process for two reasons: First, to point up the criteria used for the selection, and second, to clear up the existing confusion. Surprising as it may seem, the valuing agent is presently a hotly-debated issue, and further, some writers shift from one valuing agent to another, apparently without ever recognizing what they have done.

The selection of the valuing agent arises from considerations outside the model. The model of the enterprise has no inherent preference for any particular position or commodity. It is indifferent. However, if the trader were truly indifferent, as the model suggests, between the two commodities, we would arrive at the anamolous position of the impossibility of losses.

Suppose that the trader enters the market with 100 bushels of wheat and purchases 100 dollars. If the price of money (in terms of wheat) now goes to zero, the trader still holds the 100 dollars and has suffered no absolute loss.[50] In the same fashion,

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[50]It is true that he has suffered an opportunity loss by not waiting until the dollars could be obtained without the sacrifice of the wheat, but his position has not been diminished by the price change.

if the trader enters the market with 100 dollars and purchases 100 bushels, and the price of wheat (in terms of money) then goes to zero, he still holds the wheat and has lost nothing.

The only thing that is being said in the above example is that the quantity of a commodity held is not affected by a price change. It would appear reasonable to assert that if the trader has a given amount of utility associated with a given quantity of a commodity and that quantity remained constant, then the utility would remain constant. That is, if utility is associated with the quantity of a commodity there is no possibility of diminishing the utility and hence no possibility of a loss.

Obviously, this is not the case. The trader undoubtedly has satisfaction from holding a consumable good, such as wheat, but due to the declining marginal utility of the consumption of a particular good, his total utility is increased by exchanging for some good which has a higher utility.[51] Thus, the decline in price of a held good directly causes a decline in the utility of the holder. Moreover, the magnitude of decline in utility varies directly with the quantity of the commodity held; the greater the quantity held, the greater the decline in utility if the price of that commodity decreases.

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[51]The exchange will, of course, continue until all the marginal utilities of all goods have been equated. Cf. any basic economics text.

It is true that a consumable commodity has an absolute floor of utility which is positive while the floor of a price is zero. Thus, in some cases, a price decrease would be greater than the utility decrease. This is a genuine problem in personal income measurement, but it is not a problem of enterprise income measurement. When this floor is reached, the "trader" would become a "consumer" of the commodity and thus subject to the Fisher analysis. This problem is avoided in the present analysis for two reasons: First, the model has restricted the activities to exchanging and holding, and has excluded consumption; and second, we are here trading wheat contracts which have negligible consumption properties.

The point is a simple one. The process of exchange outside the model increases the utility of the trader qua consumer. Money is the general expression of the ability to exchange in a market economy. In an "n" dimensional diagram, the money surface relates all the goods to money which then allows the relation of all goods to one another. Money is the single numéraire which performs this relational function and is therefore superior to wheat as a valuing agent.

It is true that money has no value except in exchange, but, in the model, the wheat contract has no value except as it relates to money. Money has value as it relates to all other wants of the trader, but wheat is one step removed from "value" to the trader qua consumer. For this reason, money is riskless (assuming a

stable price level) because there can be no decline in its ability to yield utility, but wheat has a definite risk attached to it since its ability to yield utility depends on its ability to be exchanged for money.[52]

For these reasons we draw the obvious conclusion that money is the superior valuing agent. Money is the general expression of the command over goods. We assumed above that there was utility in the very act of being able to command goods, and here we find money to be the proper expression of the utility, albeit money increments may not equal utility increments.

The Maximand of the Enterprise. --We assumed above that the maximand of the trader was utility. Further, we pointed out that the enterprise's motive force was provided by the trader and hence could also be stated as the maximization of utility, and then we concluded that the vehicle for maximization was money. It follows that the maximand of the enterprise is money or the ability to command money.

This conclusion is neither startling nor significantly different from the more common assumption of profit maximization. It, however, does state precisely the profit maximization assumption and leaves no room for, say, the maximization of a quantity of

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[52]Again, the holding of money has an opportunity risk attached insofar as the trader might miss a profitable exchange, but there is no risk of any utility decrease if there is a stable price level.

wheat with a zero price.[53]

The author is aware of the contribution by the empiricists and behaviorists to motivation theory and the consequent weakening of the strict interpretation of profit maximization. There is no quarrel with these contributions in this study. On the contrary, our total understanding that has been enriched by Burnham's "separation of ownership and control," Lester's questionnaires,[54] Simon's "satisficing,"[55] Boulding's insistence upon a return to utility[56] and a host of other contributors and concepts.

Three separate (but related) arguments may still be advanced in spite of these contributions.

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[53]Many authors state the assumption as maximization of "money profit" (e.g., Alfred W. Stonier and Douglas C. Hague, A Textbook of Economic Theory, New York: Longmans, Green and Co., 1953, pp. 87-88), or "financial profits," and in one case at least "make money" (Lawrence Abbott, Economics and the Modern World, New York: Harcourt, Brace and World, Inc., 1960, p. 137). The vast majority state the maximization of profit without a modifier, which leads Boulding to note that "the quantity which is supposed to be maximized does not exist!" (Boulding, The Skills of the Economist, Cleveland: Howard Allen, Inc., 1958, p. 56). Perhaps profit in the abstract doesn't exist, but money increments do, and that, for better or worse, is our assumption.

[54]Richard A. Lester, "Shortcomings of Marginal Analysis for Wage-Employment Problems," American Economic Review, XXXVI (March 1946).

[55]Herbert A. Simon, "Theories of Decision-Making in Economics and Behavioral Science," American Economic Review, XLIX (June 1959).

[56]Boulding, Skills, p. 28.

First, one can assume cet. par. That is, if all other things to be maximized or satisficed (e.g., leisure of trader, customer goodwill, potential entrants and competitors, taxation, empire building, management-owner-creditor-taxing authority-consumer-labor conflicts, prestige, etc.) remain constant, it is reasonable to assume that a larger profit will be preferred over a smaller profit.

Second, if some maximand is not posited, it is impossible to make either preferential or determinate statements about anything. That is, a theory or construct must be set up about the nature of the thing described before a meaningful description can be made.[57] Without the positing of profit maximization, all of the recent advances in decision theory, and most particularly in capital budgeting, would be invalid. The irony of invalidating decision theory is that it would no longer be available to help entrepreneurs maximize profits because of the assumption that they don't maximize profits.

Finally, and most important for this study, is the fact that we made this assumption only for the purpose of selecting a valuing

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[57]This, it should be emphasized, is not peculiar to, and a limitation on, the social sciences as many would have us believe. It is equally true of the queen of the physical sciences, physics, as Caws so eloquently points out. Peter Caws, "Definition and Measurement in Physics," Measurement: Definitions and Theories, eds., C. West Churchman and P. Ratoosh (New York: John Wiley and Sons, Inc., 1959), pp. 3-17, esp. pp. 3, 8, 14, 15, 16. See the section on "measurement" in this study for an elaboration.

agent, a selection which the reader would probably have granted without the analysis. Once the valuing agent has been agreed on, the decision model that is presented below can be equally well utilized for minimizing the money profits if that is what is desired.

The above arguments should not be interpreted as an attempt to negate other goals of the enterprise. Solvency, for example, is obviously a prerequisite for the continuity of operations. Thus, if the objective of continuity of the enterprise exists, solvency is necessarily a sub-objective of continuity. Likewise, however, continuity is a sub-objective of money-profit maximization. It may be necessary to make the objective more precise by adding the modifier "long-run,"[58] but the fact remains that there is "one overriding goal: the maximization of money profits."[59]

Continuity, per se, may very well be the overriding goal of a sub-group, such as management, but it is inconceivable that even the managers would continue if there was a "better" (more profitable) alternative available cet. par. It is certain that the

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[58]This may become a dead issue as the distinction between the "runs" becomes less clear through further research and refinement. For example, Eirik G. Furubotn ("Investment Alternatives and the Supply Schedule of the Firm," unpublished paper presented at the Annual Conference of the Southern Economic Association, Roanoke, Va., November 15, 1963), takes the position that the entrepreneur, in a complex industrial society, must constantly be working in a mixture of "runs" for his investment decision.

[59]George J. Stigler, The Theory of Price, revised edition (New York: MacMillan Co., 1952), p. 148.

owner would not continue if there was, cet. par., a better alternative. In short, the author casts his lot with Berle when he observes:

> ...it is still true that a non-Statist economic organization cannot continue to exist and enjoy power (let alone enhance its position) unless it makes profits. Therefore the operation of such organizations must be directed toward reaping profits, and they must move within the general limitations of the profit system.... Increased capital for a corporation means increased power. Capital losses mean loss of power and eventual extinction...[60]

In summary, we assume:

1. The trader's maximand is utility.
2. The raison d'être of the enterprise is to maximize the trader's maximand.
3. Utility varies in the same direction as the ability to command goods and services.
4. Money is the appropriate expression of the ability to command goods.
5. Therefore, the prime maximand of the enterprise is money (or ability to command money) and the correct valuing agent is money.

The Timing of the Measurement

As noted above, the problem of selecting a valuation coefficient arises only when the exchange is incomplete. The measurement can be stated as two alternative times:

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[60]Adolph A. Berle, Jr., Power Without Property: A New Development in American Political Economy (New York: Harcourt, Brace and Co., 1959), p. 90.

1. The timing of the measurement is determined by the state of the exchange, i.e., income is measured (assets valued) at the time the exchange becomes complete.

2. The timing of the measurement is determined by an external desire at some particular instant in time regardless of the state of the exchange.

Alternative (1) is the trivial solution: since the valuing agent has a valuation coefficient of unity (by assumption) and the state of a completed exchange is when the assets are homogeneous in the form of the valuing agent (by definition), there is no problem in the measurement of income.

Alternative (2) embodies the significant problems. Indeed the underlying problem of this study can be stated as a desire for income measurement when the exchange is incomplete.

The impetus of this desire is obvious: information is wanted. Information is required because time has reached some specified instant, because time has elapsed since the last information was received. Thus, the concept of income has a vital, indispensable, temporal dimension. The desire for information is the prime cause of the measurement, and this desire occurs at some instant in time. We may say then, that time is the fundamental, independent variable of the measurement of income. The advent of a specific temporal location triggers the measurement. Moreover, income is a concept bounded by time; it is within a time interval; contained between two specified instants of time. Simons has cautioned against neglecting this relationship:

> The relation of the income concept to the specified time interval is fundamental--and neglect of this crucial relation has been responsible for much confusion in the relevant literature. The measurement of income implies allocation of consumption and accumulation to specified periods. In a sense, it implies the possibility of measuring the results of individual participation in economic relations for an assigned interval and without regard for anything which happened before the beginning of that (before the end of the previous) interval or for what may happen in subsequent periods. All data for the measurement would be found, ideally, within the period analyzed.[61]

Unfortunately, Simons' charge has been ignored, forgotten or misunderstood. Neglect of the temporal dimension is still a problem and confusion is still the result.

Information is desired at an instant in time about the events within a time period. A measurement is made and the results are transmitted in accordance with this desire. If the exchange is complete, there is no problem. If the exchange is incomplete, the measurement is made by means of a valuation coefficient. One overall criterion for the selection of a valuation coefficient is its "informational content." The valuation coefficient that contains the most information is the one that should be selected. Thus, our first criterion.

Criterion I: A valuation coefficient which yields more information is superior to a valuation coefficient which yields less information.

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[61]Simons, Personal Income Taxation, p. 50.

As it stands this criterion is much too general to be of use in this study. "Information" is a complex concept. In order to make the criterion applicable to the problem at hand, it is necessary to examine the concept of information in some detail. That examination is the purpose of the next chapter.

Summary

The purpose of this study is to develop a theory of measurement of income for a trading enterprise. Hicks' definition of income is accepted by most scholars and we will utilize it as a basic premise in this work.

The problem lies in the various implementations of the definition in the measurement of wealth. There are four competing concepts of valuation: (1) The Fisher Tradition, (2) The Accounting Tradition, (3) Market Value, and (4) Boulding's Constant.

A trading model will be utilized to analyze the problem. Such a model has the virtue of simplicity and will allow us to picture all possible positions that the trader can obtain. The activities of the trader in this model are restricted to holding or exchanging along a completely defined and externally determined route. We call this route the "transformation coefficient."

The position of the trader must be expressed as a value in order to determine his wealth. We call this value expression the "valuation coefficient." There are four alternative valuation coefficients, three of which are transformation coefficients:

1. The Fisher Tradition--Future transformation coefficient.

2. The Accounting Tradition--Past transformation coefficient.

3. Present Market--Present transformation coefficient.

4. Boulding's Constant.

When all assets are held in the form of the valuing agent we will call this "a complete exchange." The valuing agent is assumed to have a value of unity and thus the income is subject to an unequivocal measurement under conditions of a complete exchange. An incomplete exchange is defined as assets held in a form other than the valuing agent. Thus, the problem was recast as selecting the correct valuation coefficient under conditions of an incomplete exchange.

After a consideration of the nature of the enterprise, money was selected as the proper valuing agent. This was done by assuming that the trader's motivation is utility. We noted that there are two sources of utility: (1) consumption and (2) command over goods. Money is the general expression for command over goods and is the media for obtaining consumption. The trader furnishes the motive force for the enterprise, hence the maximand of the enterprise is money profits.

An inquiry into the reason for the valuation of assets led us to the obvious conclusion that information was desired prior to the completion of the exchange. Thus, our first criterion for

selection of a valuation coefficient is the information which it furnishes. The concept of information is the subject of the next chapter.

CHAPTER II

INFORMATION AND COMMUNICATIONS

In the preceding chapter we pointed out that the general criterion for the selection of a particular valuation coefficient is its information content. A possible reformulation of the problem is as follows:

> Determination of the informational content of the alternative valuation coefficients.

If we could determine the informational content of each valuation coefficient, we could apply Criterion I and the problem of this study would be solved. Before this can be done we must review some of the general characteristics of the concept of information. Such a review is the purpose of this chapter.

In the succeeding chapter the concept of "measurement" will be discussed. The two concepts--measurement and information--are difficult to delineate in any meaningful fashion, hence the discussion will overlap at several points. For purposes of clarity, however, we will attempt to separate the concepts and discuss them seriatim.

The terms "information" and "communications" are used synonymously in the literature.[1] We will break with the traditional

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[1]For example, Claude Shannon's pioneering work was entitled The Mathematical Theory of Communications, (Urbana, Ill.:

usage in an attempt to be more precise. We will use "communications" as a general term describing the transmission of unevaluated messages. "Information" will be restricted to the description of useful messages.

Information

If a message is to be useful there are two essential prerequisites: (1) verity and (2) relevance. If a message does not describe reality, it is obvious that its usefulness is, at least, severely limited. Likewise, the message must be relevant to the problem under consideration before it can be of use to that problem.[2]

University of Illinois Press, 1949) and Stanford Goldman's "thorough discussion of that work" was entitled Information Theory (New York: Prentice-Hall, 1953). This is because of the simple expedient of including one's self in the category of those to be communicated with. The elementary definition is "self-information," and the theorists conceive of communicating with the self as well as with other interested parties.

Likewise, in measurement theory the notion is that one measures in order to communicate with himself as well as with others. Churchman argues that all measurements fall in the category of communications. He writes:

> Robinson Crusoe cannot bring along his hut as he searches for a flagstone for his hearth. But he does need to compare an expreience on the beach with a past experience in his hut....Even if there were but one mind in all the world, such a castaway would need to compare the experience of one moment and place with that of another moment and place. He would have to communicate with his own past. C. West Churchman, "Why Measure?" Measurement Definitions and Theories, eds., C. West Churchman & P. Ratoosh, (New York: John Wiley & Sons, Inc., 1959), p. 89.

[2]McDonough describes information as having two basic attributes, validity and value:

Verity

The concept of verity may be described as "conformance with reality." In its simplest form it is nothing more than "truth." The nature of reality and truth has been the subject of extended analysis in the philosophical literature. It is not our purpose either to resolve or review these discussions. The dispute over what is "real" as opposed to a "product of the mind" or the Kantian reversal would lead us too far astray at this point. We will take the easy way by briefly describing the attributes that are germane to this study.

Reality is subject to distortion by (1) perception errors and (2) deliberate misrepresentations. Both are fundamental and both are intertwined. One can be certain of misrepresentation only if he is certain of his perception of reality. However, it is easy to define intent to misrepresent, albeit it may be impossible to prove. Difficulties of proof aside, we submit that intent to inform rather

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> Validity implies that one can have confidence in a statement whereas value indicates that the statement is worthwhile knowing. (p. 87)

Validity in his context must be a synonym for "truth." This is an odd use of "validity." It usually applies to arguments, not information. Perhaps he was also trying to avoid a metaphysical discussion by avoiding truth concepts. We use verity and explicitly skirt the metaphysics.

We disagree with McDonough when he describes "validity [verity] as the prime characteristic inasmuch as it is a prerequisite to value" (p. 87). We see no reason to rank the two attributes. Irrelevant information is valueless regardless of its verity. Adrian M. McDonough, Information, Economics and Management Systems (New York: McGraw-Hill Book Co., Inc., 1963).

than to deceive is a prerequisite of verity and hence of information. If the intent is to deceive, it should be named misinformation.

Errors of perception are not so easily resolved. There has been sufficient experimentation to shake one's confidence in perception reports regardless of the honesty of the reporter. The classic cases from psychology texts are too well known to be repeated here. Suffice it to say that the best intentions do not necessarily guarantee a veritable message.

Our concern is with quantitative data and thus any errors of perception would be matters of degree. If the intent is to inform, but the reporter misperceives the data, there will be some lack of verity. The usefulness of data that have only a degree of verity is not amenable to generalization: It would depend upon the requirements of the specific situation. Note, however, that in the absence of other information the misperceived report is the only basis for action and therefore should be classified as "information." That is, some description of reality is better than none, even if the description has some degree of error.

Metricians often list errors of perception as one of the causes of imprecision in measurements. A more complete discussion is left to a later chapter, but, in this connection, we must point out that precision has little to do with verity.

"Absolute" precision is impossible to conceive, much less achieve. Limitations of precision are caused by the instrument of measurement as well as the perception of the scale by the

metrician. In addition, the limitation of the unit is crucial when the data are continuous. It is possible to conceive of an "absolutely precise" measurement in a given unit, but it is always possible to use smaller units and hence a more precise measure. A given unit may be halved and then halved again until it becomes very small, but this unit is always subject to a further fractioning and is, therefore, always imprecise in terms of the smaller unit.

This has caused some metricians to complain that no message is ever completely veritable because it is never absolutely precise. We take a more generous and a more pragmatic view. The message "that water is hot" lacks precision. It may be that it is so imprecise as to be useless. The state of being useless, however, is not a result of veritableness (perhaps all would agree that it was hot) but a result of the lack of precision. The degree of precision required to be useful depends upon the specific problematic situation. As a warning to a child, "hot" would be enough, but in a scientific experiment it would not be.

The same could be said of a more precise transmission, say, "It is 90°F." It is almost certain that the "true" temperature is different from 90.00° and thus it may be useless for certain problems. However, if the transmitter was trying to inform rather than deceive, we would classify the message as "veritable."

The point is that a message, measurement, may be veritable but not precise. The contrary condition does not hold. If the measurement is "precise," it is veritable. A measurement that is both

precise and veritable may still be useless, but to be useful, it must be veritable. Hence, the first information criterion.

Information Criterion I: Messages must be veritable. One attribute of verity is the intent of the informant.

Relevance

The second attribute of information as presented by McDonough is its "value." We have here selected the word "relevance" to replace "value" because we have already overworked the latter and, more importantly, we intend to argue that relevance is a more appropriate term.

A strong case can be made that all information is valuable simply because it presents the individual with a more complete picture of reality. At the psychological level, an individual is receiving information at all times. He is immersed in an environment which is continually sending messages (stimuli) to his perceptors. One can argue, a priori, that it is valuable for an individual to have knowledge of his environment and transitively, all information is valuable.

> The sequence begins with the environment of the perceiver considered at the level of ecology.[3]

The individual does not utilize all the messages which are received at the ecological level, however. Most of them are shunted off

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[3]W. I. Gibson, "On the Nature of Total Perception," Unpublished Manuscript, p. 10, emphasis supplied.

as "unimportant," "uninteresting," or "irrelevant," and only a few are allowed through to the reasoning process. The response--if it is deliberate--will depend upon the selection of the "appropriate" (neurally determined) stimuli. This may be visualized in an over-simplified diagram as in Figure 4.

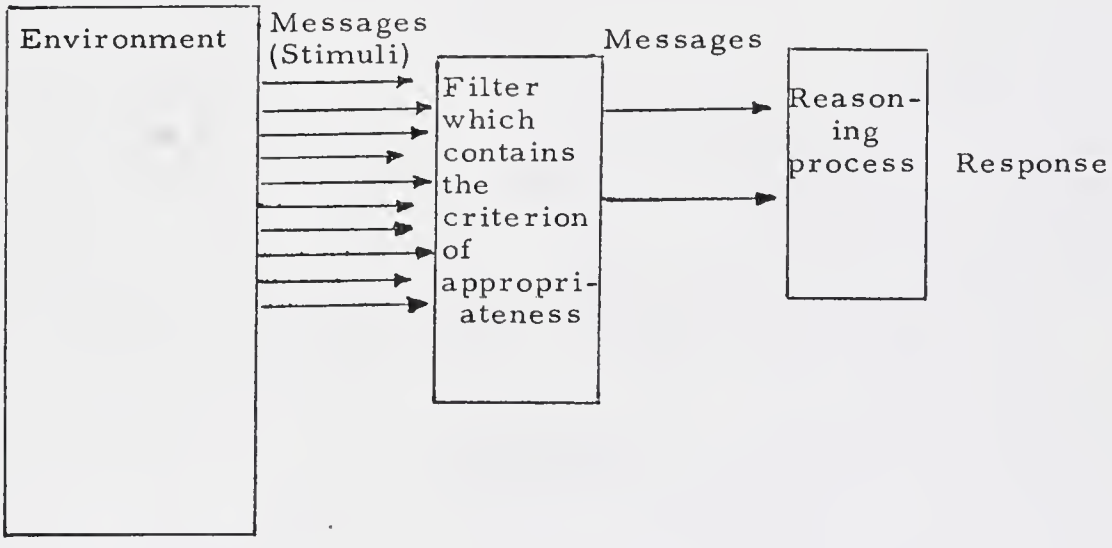

Figure 4

The number of appropriate messages is considerably smaller than the total number of messages sent. The appropriateness of the messages is determined by the problematic situation in which the organism finds itself. If the organism is hungry, it will not "hear" (i.e., the message will be shunted aside) the ticking of a clock. If the organism is interested in getting out of the woods when it is lost, it probably will not "perceive" the beauties of nature. One is probably capable of receiving, in some sense,

all the messages, but the particular situation will determine the relevance and the irrelevant will be sidetracked.

The reasoning process in the organism is set up to handle problematic situations as they occur. If there were no problems in the environment, the organism would remain in a state of nirvana which would not require responses. The organism is, however, continually required by changes in the environment to adjust, respond, so that it will maintain its homeostasis. That is, we may say that all information is valuable but not all information is relevant to the particular problem at hand. Thus, when Mr. Goldman writes:

> The quantitative theory of information which we have been developing may appear incomplete and perhaps disappointing to the reader because it does not treat the value of information. There are just as many binits in the information which tells whether John Smith's wife had a boy or a girl, as in the information which tells whether your own wife had a boy or a girl.[4]

The question must be the relevance of the information to the receiver and his problem. If the message that Smith's wife had a boy was received by Jones, it would be difficult to argue that this information was completely valueless to Jones, but it is apparent that it is irrelevant to Jones' problem.

We can sympathize with the information theorists who did not even attempt to set forth a general theory of the value of

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[4]Goldman, Information Theory, p. 63.

information. It certainly wasn't an oversight, as Mr. Goldman's statement shows; it was simply impossible. The relevance of the information to a particular problem will determine its relational value to the receiver and thus no general statement about value is possible.

Knowledge of the specific problem is required in order to ascertain relevance. That is, we must state our goal, our problem, the desired end, before we can make a judgment about relevance. This pragmatic end-directed view is the basis for our distinction between communications and information.[5] All messages are classified as communications, information is restricted to those messages which are relevant (useful) to a specified end. Thus, our second criterion.

Information Criterion 2: Messages must be relevant. Relevance refers to a particular (specified) problem.

The Theoretical Construct.--Knowledge of the problem is a requisite for relevance judgments, but it is not sufficient. An additional requirement is necessary, viz., the theoretical construct.

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[5]British theorists employ a distinction between selective information-content and semantic information-content. The semantic content refers to structure and meaning, i.e., communications qua inter-personal understanding. Compare for example, W. R. Ashby, Introduction to Cybernetics (London: Chapman and Hall, 1956), passim. Our distinction is problem-directed rather than person-directed.

In the above diagram the filter-selector is controlled by the reasoning process. Messages of search must be sent to the filter-selector from the reasoning process to determine which of the substantive messages get through. The reasoning process must then set forth the criterion of relevance so that it receives messages pertinent to the problem at hand.

The above can be restated as: The mind needs a theory. One of the functions of such a theory is to select the relevant data as well as to arrange those data in a meaningful fashion. To say that the world is too complex to be perceived in its entirety has become a cliché, but it remains true. It is necessary to set up a theory which rejects the irrelevant complexities and allows one to concentrate on the communications that can be handled by the limited capacity of the mind.

Several philosophers have taken this construct formulation one step further, and argue that the conception is a prerequisite of the information. Caws writes:

> Cassirer makes the point that all measure has to be "conceived and sought" before it can be found in experience, i.e., one has first a concept of some quality and looks afterwards for quantitative expressions of it.[6]

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[6]Peter Caws, "Definition and Measurement in Physics," in Measurement: Definitions and Theories, eds., C. West Churchman and P. Ratoosh (New York: John Wiley & Sons, Inc., 1959), p. 8.

The conception comes first and then the information. Some psychologists would argue that the "beginnings" of concept formulation are from observations. However, they are talking about the development, from infancy, of the reasoning process and are not quarreling with the central point of Caws' assertion.

Hempel devotes an entire book to the primacy of concept formulations. He goes through an interesting reductio ad absurdum argument in which he calculates the "hage" of every member of the society.

> Concepts with empirical import can be readily defined in any number, but most of them will be of no use for systematic purposes. Thus, we might define the hage of a person as the product of his height in millimeters and his age in years. This definition is operationally adequate and the term 'hage' thus introduced would have relatively high precision and uniformity of usage; but it lacks theoretical import, for we have no general laws connecting the hage of a person with other characteristics.[7]

Hempel does not say that the hage of a person is not information; he simply proves that it has no known theoretical import. That is, hage is a communication which is not relevant to any extant theory and, therefore, is without value in any problematic situation.

Koivisto delineates facts and observations in his discussion of a theory.

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[7]C. G. Hempel, "Fundamentals of Concept Formation in Empirical Science," International Encyclopedia of Unified Science, II, No. 7 (Chicago: University of Chicago Press, 1952), p. 46.

> How important a theory is to our understanding cannot be overemphasized. In fact, we cannot assert that something is a 'fact' unless we have an adequate theory. Without a theory we have only observations....Facts do not consist merely in observations; they consist in a strategic combination of observation and theory.[8]

"Facts" for Koivisto do not exist separate from a theory; "observations" do, but are without value to our understanding. In our terminology the facts are "relevant information"; observations are "communications."

The functions of a theory are (1) to select the relevant information from a myriad of complex observations and (2) to arrange the information in comprehensible combinations.[9] The former is the basis for our proposition.

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[8]William A. Koivisto, Principles and Problems of Modern Economics (New York: John Wiley & Sons, Inc., 1957), p. 13.

[9]Of course this is a theoretical construct about theoretical constructs on which disagreements are legion. There are many different schools on the nature and functions of theories. All of them, however, except the pure positivists, would accept this statement. The pure positivists would insist that the selection of data was a "result" instead of a "function," but they would not deny that inductive theories eventually serve as selectors. For example, compare Alfred J. Ayer, Language, Truth and Logic (New York: Dover, 1946). N. R. Campbell is not as "pure" a positivist as Ayer and he freely admits the primacy of construct.

For less general discussions that are specifically directed toward the social sciences, see Robert K. Merton, Social Theory and Social Structure, especially Chapter 9 on collective terms. On economics, see for example, J. N. Keynes, Scope and Method of Political Economy (London, 1890); Joseph Schumpeter, Economic Doctrine and Method (New York, 1954); T. W. Hutchison, A Review of Economic Doctrines, 1870-1929 (Oxford, 1953); Alan G. Gruchy, Modern Economic Thought (New York, 1947). Specific criticism of operationalism may be found in Andreas Papandreous, Economics

Information Proposition 1: The theoretical construct is the locus of the criterion of relevance.

Communications

The quantitative theory of communication is a solution to an allocation problem. Messages are outputs that have costly inputs. The problem is to maximize the quantity of information and minimize the cost of that information. That is, the scarcity and concurrent allocation-efficiency problems are met. Shannon's work was an attempt at a general solution to this problem.

As Goldman points out in several places, information theory measures "the quantity of information, not its value."[10] More directly, communications theory assumes, for purposes of the theory, all information to be valuable and the attempt is to maximize the amount available. In the quote about the sex of the child (supra p. 54) the number of "binits" in a particular message is the important datum with no method of ordering those binits by value. Regardless of this serious limitation, the concepts and terms of

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as a Science (Philadelphia, 1958), and Fritz Machlup, "Operational Concepts and Mental Construct in Model and Theory Formation," Giornale Degli Economists Annali di Economia, September 1960, p. 3.

[10]Goldman, Information Theory, p. 300.

quantitative communication theory are helpful in the present connection.

The prime difference between communications theory in this context and the psychological view presented above is the spatio-temporal separation of the environment and the receiver. Contrary to the psychological situation where the receiver is immersed in the environment and continually receiving unlimited messages without cost, the receiver in this situation has a cost and/or a limitation attached to the binits received. It may be helpful to visualize this as follows:[11]

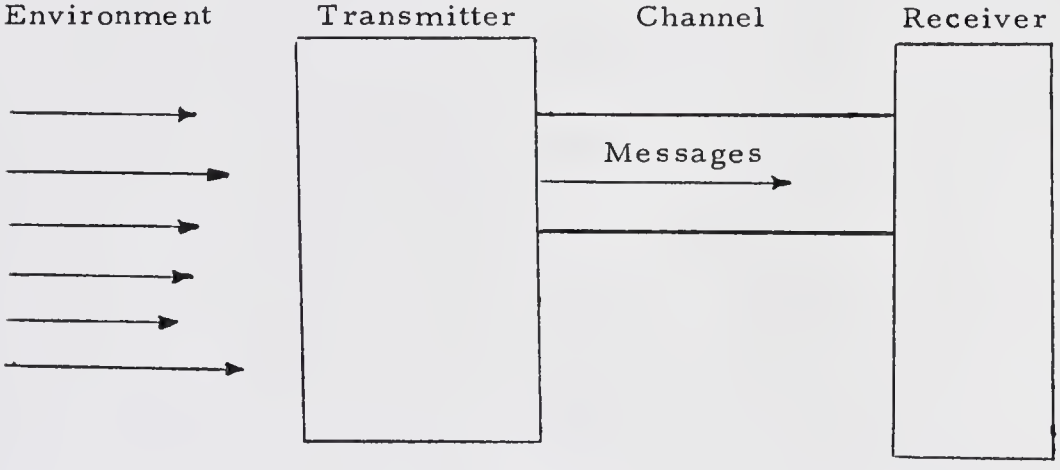

Figure 5

This diagram is useful because it points up two important facets in communications:

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[11]This is a simplification of Shannon's presentation. He set up five basic elements: (1) Information Source; (2) Transmitter; (3) Channel; (4) Receiver; (5) Destination. (Claude Shannon and Warren Weaver, The Mathematical Theory of Communications (Urbana, Ill.: University of Illinois Press, 1949), p. 5.

1. The limitation of the channel, or conversely, the additional cost of increasing the channel capacity.
2. The selection of relevant information has been shifted from the internal logical process (theory) of the receiver to the transmitter.

The limitation of information imposed by the channel capacity is all the more reason for insisting on the relevance of the information to be transmitted. Suppose that the channel was limited to x binits of information and there were two messages to be sent, both containing exactly x binits. A choice is enforced but there is no criterion in communication theory for making that choice. For example, if the two messages were:

(1) The sex of Smith's child is a boy.

(2) The sex of Jones' child is a boy.

There is no way of choosing which message to transmit unless the transmitter knows the identity of the receiver. In more general terms, the transmitter needs to know the problem of the receiver before he can make an intelligent choice of the message to be transmitted.

An obvious "solution" to the problem is either to reverse the origin of the message or to select one randomly and wait for the "feedback." Note, however, that this solution solves the "problem" by denying the existence of the problem. Admittedly, feedback is a valuable method of controlling transmissions, but note

that it utilizes some of the channel's scarce capacity. Thus, it would either require the addition of capacity and the corollary costs or the omission of at least part of the substantive message. The solution is trivial because it disregards the constraints which are the cause of the problem.[12]

The limitation of channel capacity places an extremely heavy burden on the transmitter. This is the problem that the newscaster faces daily. He has a severely limited channel (time) and must select for transmission from a vast array of things, all of which may be classified as "news." His problem is compounded by having a great many receivers with a wide variety of interests (purposes) and hence the "value" (relevance) of the information selected will probably be different for each.

It is appropriate to reiterate that quantitative information theory is of no help in the newscaster's dilemma. For example, assume that the probability of a presidential assassination is greater than the probability of snow in Miami Beach. The calculation of

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[12]This is precisely the author's reaction to the "Different incomes for different purposes" notion. If it is economically feasible for each receiver to feedback his particular "purpose" and then the transmitter to prepare and transmit all of the information requested, there is no problem. If the channel has such a large capacity, and the corollary large costs, the non-problem has been solved in such a trivial fashion that it should never have been raised.

the quantity of information is determined by the formula:[13]

$$I(x) = -\log_2 P(x)$$

Here P(x) is the probability of event x occurring and I(x) is the measure of the quantity of binits. Thus, the smaller the probability the greater the number of binits. On this basis, snow in Miami Beach would be transmitted. Obviously, something is wrong. The quantity I(x) needs a "valuation coefficient" based upon the relevance.

Also, as above, feedback is not the solution. In addition to the capacity constraint, there are two other criticisms of feedback.

First, the old saw that "nothing is as dead as yesterday's news" is an indication of the time value of information. Since feedback requires the additional time necessary to transmit at least two additional messages, the value of information obtained through feedback is considerably less than that obtained in the initial transmission. It is true that feedback may aid the newscaster in developing a criterion of relevance for use in the future, but the immediate use of feedback is the result of either wrong or incomplete data in the transmission. That is, feedback is used to correct errors and obviously it would be better to avoid errors.

The second criticism of feedback is even more fundamental. Feedback is a function of the information possessed by the receiver.

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[13]H. Bierman, L. Fouraker, R. Jaedicke, Quantitative Analysis for Business Decisions (Homewood, Ill.: Richard D. Irwin, Inc., 1961), p. 308. In this work, I(x) is called the "value" of information. They use value in its mathematical sense; it means "quantity of binits."

If the receiver has inadequate information, he is very likely to ask the wrong questions. For example, suppose that Jones receives a message informing him of the sex of Smith's child. If Jones did not know that his wife was pregnant, he would have no basis for feedback. In the case of our newscaster, the receivers do not ask specific questions, such as "Was the president assassinated today?" or "Was there snow in Miami Beach?" The number of such questions is infinite and the capacity is finite. The question that the receivers implicitly ask is, "What's new?" and the transmitter makes the judgment. If all the transmitters decided to transmit snow in Miami Beach and omit the assassination, it is extremely unlikely that any receiver would feedback a question about the unknown assassination. It is clear that in such a case the transmitter(s) have complete control over what they transmit and therefore have a high degree of control over the feedback. The transmission determines the knowledge of the receiver and thus delineates the area that feedback will be concerned with. Reliance upon feedback as a criterion of relevance is thus clearly impossible.

The conclusion is inevitable: In a communication system the criterion of relevance is located at the transmission source. The transmitter must select what is to be transmitted.[14] Thus,

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[14]This is not an attempt to justify such a situation. We can note the Cybernetics situation in which a low-energy information system has absolute control of a high-energy power system and join with Parsons in viewing the analogous social systems with alarm. We can join with the general outcry against the manipulation possible

our first communication proposition.

Communication Proposition 1: The locus of the theoretical construct (which determines the relevance criterion) is at the transmission source.

The above proposition is concerned only with the locus of the relevance criterion at the time of transmission. A legitimate question can be raised about the origin of that criterion. It is necessary for the transmitter to possess the criterion, but how does he come by it? Does he ask the receiver? If he does, he will utilize some of the scarce channel capacity, but, more importantly, he is very likely to get different answers from different receivers and thus be in no better position than before. That is, the receivers are likely to have different purposes and different levels of sophistication which will result in a wide variety of requests.

The "ask the receivers" notion makes the implicit assumption of de gustibus non disputandem and this should be examined.

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in the discretion allowed the transmitter and deplore the nefarious effects of an ill-motivated transmitter. The above analysis is an attempt to present the inevitable result of a limited channel communication system. Although the purpose and methodology is different, our conclusion is, at the core, the same as Carr's, "Propaganda is as essential a function of mass democracy as advertising of mass production," (Edward H. Carr, The New Society (Boston: Beacon Press, 1957), p. 69) and we join with him in his reluctance to announce such a conclusion. The broad social consequences of that conclusion are beyond the scope of this essay.

This assumption would not allow us to ask about the origin of the construct. Instead, it takes it as a given datum and proceeds from there. The notion is pervasive in present society and is given an honorific aura by associating it with other honorific terms like "democracy" and "consumer sovereignty." We could agree that if tastes were given--original with the individual--a strong case could be made for not tampering with those tastes, and this could be done in the name of democracy. However, this ignores completely the philosophers', semanticists', social psychologists', sociologists', and cultural anthropologists' insistence that such tastes are "socialized," "acculturized," "environmentally determined," "linguistically determined," and so on. In short, learned from the cultural milieu in which the individual finds himself.

The newscaster who currently spends a considerable portion of the channel capacity reporting football scores is responding to the relevance criterion of the receivers. The reason that he does not report chess or bridge results is that the receivers are not "interested" (irrelevant). One finds this interest in football a little strange since there are certainly a great many more bridge players (and therefore people who are actively interested in bridge) than football players. In another culture the capacity would be used for chess, cricket, bull fights, or opera for the same reason, i.e., receiver's interests. The result is not commonly recognized. By broadcasting football scores, the transmitter is continuing the interest of receivers in football. The transmitter is a significant

part of the cultural milieu from which the tastes are learned. Transitively, the transmitter is, to a large extent, the determinant of tastes.

In the particular case at hand, no one would deny that the receiver has an extant construct. However, this construct was learned previously in some sort of an education-communication process. If we now ask the receiver what his construct is in order for the transmitter to establish a criterion of relevance, we have made a circle which is not complete, but certainly it is vicious.[15]

The moral is clear. The transmitter plays a major part in concept formation whether he likes it or not. He is forced into the position of making a choice between alternative roles:

1. Reinforcing the current construct by transmitting in accordance with it.
2. Changing the construct.

The escape alternative of being neutral is not available. A position of neutrality is a positive decision to continue the current

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[15]This is the position of certain income transmitters. For example, Carl Nelson (unpublished paper presented at the annual meeting of the Northeastern Accounting Association, New York, April 18, 1964) suggests that we survey the users of accounting data and the results be used as a criterion of relevance. It is almost certain that the responses would be interpreted as evidence for the status quo because the construct of the receiver has been previously (partially) determined by the transmitter. Mr. Nelson further suggests that the survey should not include alternative concepts because of the introduction of bias. What he must mean is that the survey be biased in favor of the status quo by the process of the transmitter giving the receiver only one "alternative."

construct. The refusal to make a decision is, ipso facto, a decision to continue the status quo. Thus, the transmitter must select.

Communication Proposition 2: The transmitter must choose the appropriate theoretical construct.

Proposition two does not solve any problems. On the contrary, it creates very knotty problems which were previously thought to be non-existent by the "neutrality of transmissions." These problems may be roughly divided into two categories:

1. The transmitter and the receiver with different constructs.
2. Receivers with a variety of constructs.

In the first case, the transmitter must know or be able to determine the receiver's construct. If the transmitter does not know that the receiver has a different construct, he has no problem. If, however, the transmitter knows that the construct of the receiver is different, the problem must be faced. The transmitter may then elect to transmit information in accordance with either:

1. The receiver's erroneous construct.[16]
2. The transmitter's correct construct.

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[16]Presumably if there is a difference in constructs, the transmitter considers his correct and the other erroneous. If he did not, and were rational, he would accept the receiver's construct and there would be no difference and no problem.

The consequence may be:

A. Erroneous decision either from:

1. Using the wrong information in the wrong construct, or
2. Using the right information in the wrong construct,

or

B. Correct decision which can come only from using the right information in the right construct.

However, consequence B has been ruled out. The receiver has the wrong construct by definition of the problem. Still, it is tempting to prove syllogistically that the only way to get correct decision is with correct information and thereby decide that issue. Unfortunately, the world is not that simple. It is very likely that the degree of error in the erroneous decisions varies with the information received. It is quite possible that the wrong information in the wrong construct will yield a more correct decision than the right information in the wrong construct. This is a melancholy fact that cannot be avoided. No simple criterion can be laid down for the solution of the problem. Instead, it must rest in that nebulous area of personal judgment.

One word of warning is in order however. Disciplines often become so introverted that they think technical terms are broadly understood. Scientists are inclined to impute understanding to

people who are outside of the reference group which normally employs the term. We are likely to become provincial enough to think that our everyday language is intelligible to everyone simply because of our facility. Upon reflection we would all deny that other groups understand our terms, particularly if we have recently tried some interdisciplinary communication. Nevertheless, a physicist and an economist, for example, will liberally sprinkle their communications with "entropy," "utility," "equilibrium," "acceleration," and similar terms when it is clear to a third party that the referent for these symbols is vastly different for each.[17]

In the second case--receivers with a variety of constructs--the problem is one of maximizing the total information received. Once again, however, upon analysis, this raises some unresolvable problems. Is one maximizing information when the largest number of receivers can utilize the information or when a smaller number of receivers can more fully utilize the information?

Both approaches are taken in practice. Several years ago the Air Force issued a communication memorandum which forbade the use of some words (e.g., feasible, orient, secular) because

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[17]This basic fact is often forgotten by accountants who argue that a change of income measurement would not be understood by the receivers. At the same time they lament the fact that such well-worn words as "depreciation," "surplus," "reserve," "asset," "expense," are not understood in their technical sense by the receivers. It is clear that misunderstanding now exists, yet they resist change, not because of fear of more misunderstanding, but because they think it would cause misunderstanding!

this eliminated a number of receivers. Obviously, one could push this principle to the absurd. If the number of receivers is the sole criterion we can continue to omit "difficult" words until we have been reduced to grunts or sign language. Since a large vocabulary, including jargon, enriches the communications of individuals, there is a sacrifice made each time a receiver is added. This can be visualized as a "demand curve," in Figure 6.

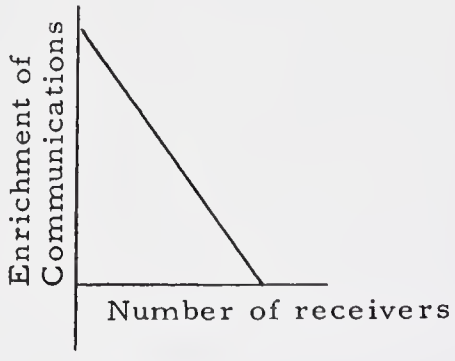

Figure 6

The marginal receiver determines the level of enrichment and results in an "enrichment deficit" of all previous receivers. It would be nice now if we could measure "information" on the y-axis and pull off the marginal information curve and stop adding receivers when it crossed the x-axis. The difficulty is that "enrichment" is not amenable to "binit" analysis so that the exercise would be futile.

The curve illustrates the opposite extreme also. As communications become richer, the receivers are cut off untilthere is only one receiver left. Both extremes are undesirable except

in rare cases. We might want to communicate to all receivers on occasion, such as civil defense warning, or only to one in a highly personal situation. Unfortunately, the vast majority of communication problems fall between these extremes. Churchman makes the point nicely.

> In sum, the language of measurement does entail a decision problem. The more precise a language the less broadly is it understood. To put it otherwise--if one wanted to be cute about it--the clearer a language the more confusing it is to most people. Precise languages narrow the class of users but increase the degree of refinement that any user can attain. The proper balance between breadth and depth is the linguistic decision problem of measurement.[18]

The final criterion for this situation will be, at least in part, determined by the theoretical construct in which the information is applied. Obviously, if the construct specifies precision that is not available, our level of confidence in the outcome will be lowered. If we pursue this, however, we will simply begin a search for a criterion for confidence levels and eventually wind up in an infinite regression. Suffice it to say at this point that we have pointed up the language problem without solving it.

One implication of both problems--different construct and different receivers--is the need for the use of at least some of the channel capacity for educational purposes. If progress is going to be made, erroneous constructs will have to be replaced and the

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[18]Churchman, "Why Measure," p. 87.

sophistication of the receivers will have to be raised. Clearly, an allocation of channel capacity to this function has a high priority. Higher than the communication of binits if those binits are to produce dangerously erroneous decisions. Perhaps not so high if they produce only slightly erroneous results. This is a difficult judgment for the transmitter, but it must be made.

We agree with Ogden and Richards. As early as 1923 they observed:

> The old view that the only access to a subject is through prolonged study of it, has, if it be true, consequences for the immediate future which have not yet been faced. The alternative is to raise the level of communication through a direct study of its conditions, its dangers and its difficulties. The practical side of this undertaking is, if communication be taken in its widest sense, Education.[19]

Thus, our third proposition.

Communication Proposition 3: Education has a high priority in the allocation of channel capacity.

Binit Maximization.--Once all the requirements set forth above have been met, we can return to the simpler problem of maximizing the number of binits. We agree with the implicit assumption that cet. par. binits should be maximized, but we

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[19]C. K. Ogden and I. A. Richards, The Meaning of Meaning (New York: Harcourt, Brace and Co., 1948), p. x.

consider verity and relevance to be essential prerequisites. Recognition of these prerequisites presents us with some problems which communications theory in its present state cannot handle.

The theory in its present state is concerned with economizing channel capacity by statistical theorems. It allows one to maximize the binits transmitted under various channel conditions--noisy, lossy, etc. This is a great contribution, but we note Brillouin's warning as well as his hope.

> Information has received a purely statistical definition from which all human elements are excluded: moral import, scientific significance, artistic quality, even speculative value in business...Not one of these concepts, essential though they are to the usual meaning of the word "information," comes within the ambit of our definition...It is essential to emphasize these restrictions, which correspond to the present state of affairs in the theory. We may hope one day to be able to discard these barriers but we cannot, at the moment, foresee how it will be possible.[20]

Unfortunately these restrictions have not always been heeded. Guilbaud cites cases where popularizers have calculated the "worth" of a daily newspaper" and finds it to be a hundred thousand hartleys."[21] ("Hartley" is a binary choice.) He points out that it is "absurd" to make such calculations and that communications theory was not designed for this purpose. For this reason,

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[20]Quoted by G. T. Guilbaud, What is Cybernetics? (New York: Criterion Books, 1959), p. 59.

[21]Ibid., p. 60.

it is clear that we cannot meaningfully calculate the binits per message for each valuation coefficient. On the other hand, it is clear that, if we could specify the problems and constructs of the various receivers, we could make some relational judgments about the competing concepts. Once this has been done, we can then maximize the information per message without cardinally measuring the binits.

The concept is both simple and familiar.

> ...information in cybernetics is not concerned with what we actually say in our messages, but rather with what we could say. What is of interest to our theory is the choice, the range of possible messages.[22]

The theory of choice is not an unfamiliar topic in economic tracts. Rogers brings this even closer to home by an analogy.

> Just as entropy of a source was likened to the output of a steel mill, so, as Shannon has remarked, can capacity of a channel (in bits/signal or bits/second) be likened to the maximum load capacity of a conveyor belt (in tons/day). If entropy (steel output) is below channel capacity (belt capacity) we know that the information (steel) produced can be satisfactorily transported, provided that it is properly coded (cut up, arranged and packed onto the moving belt).[23]

We can speak of more or less steel without ever measuring it or even specifying what a ton is. We can conceive of flexible capacity and minimize it without measuring the output.

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[22]Ibid., p. 59.

[23]Hartley Rogers, Jr., "Information Theory," Mathematics Magazine, XXXVII, No. 2 (March 1964), p. 73.

This is the framework which we will utilize below when we speak of binit maximization. In our context it is an unspecified unit that we use to order or rank the quantity of information.

Summary

It has been pointed out that a desire for information was the impetus for a measurement prior to the completion of the exchange. This necessitates a discussion of the concepts of information and communications.

We defined communications as unevaluated data and restricted information to useful data. Information, so defined, has two fundamental attributes. It must be veritable and relevant. Verity refers to "conformance with reality" but for our purposes the intent of the transmitter is the overriding requisite. Relevance refers to the applicability of data to a particular problem. Theoretical constructs serve the function of specifying what data is relevent.

In communications there is a spatio-temporal separation of the transmitter and receiver. This results in a shift of the criterion of relevance from the receiver to the transmitter. Thus, the transmitter must select the appropriate construct. This causes some difficult problems for the transmitter and necessitates the allocation of some capacity to the explanation of the constructs. In the succeeding analysis we will utilize the terms and concepts of communication theory without necessarily assigning them numerical values.

One obvious conclusion of this discussion is that we must carefully spell out the theoretical construct(s) appropriate to the trader model before we can make informational judgments about the various valcos. Luckily, there is no controversy over the correct constructs in our simple model. We will present them below.

This chapter has been unable to avoid completely the province of measurement theory. A more complete discussion is the object of the next chapter.

CHAPTER III

MEASUREMENT

The purpose of this study is to develop a theory of the measurement of enterprise income. It was noted that the impetus of the measurement was a desire for information and the first criterion of "informational content" was developed. Thus, we discovered the cause of the problem--to provide information--but we neglected the question of why provide "measurement-type" information. There are other kinds of information--e.g., "qualitative"--that could be provided and there is no a priori reason for deciding on the measurement type. An examination of that question and a review of the concept of measurement is the purpose of this chapter.

The Definitional Dispute

A burgeoning literature on metrics has appeared in recent years. Much of it has been concerned with the proper definition of measurement and a major debate has arisen. The term "measurement" is defined and used by physicists, psychologists and philosophers of science sometimes in strikingly different, sometimes in subtly different ways. Whoever expects to find a single,

well-established definition current among specialists in all these fields will be disappointed. Disputes as to the possibility of the "measurement of sensations" (sensory events) have been sufficiently acute, so that one learned society--The British Association for the Advancement of Science--appointed a special committee to study the matter. This committee devoted much of its time to a discussion of the meaning of the term "measurement." It has been said that "they came out the same door that they went in." Its reports revealed striking disagreement among its members.[1]

In a passage which probably contains reference to the work of this committee, Campbell (a physicist), who served briefly as a committee member, says:

> A philosopher will suppose that the logical analysis of measurement is familiar to every physicist who actually measures, and he will not expect me to say anything that is not to be found in every competent textbook. He is reminded therefore that most physicists have a horror of logic and regard an accusation that their doings conform to logical principles as a personal insult. The most distinguished physicists, when they attempt logical analysis, are apt to gibber; and probably more nonsense is talked about measurement than about any other part of physics. When an international congress meets to discharge the dull but necessary duty of finding the conventions of measurement (which duty it performs admirably), a flood of incomprehensible verbiage about

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[1]A.Ferguson, et al., "Quantitative Estimates of Sensory Events," British Association for the Advancement of Science, 1938: pp. 277-335, and 1939-1940: pp. 331-349.

> 'units and dimensions' is let loose, which leaves everyone even more muddled than they were before. The only conclusion that can be drawn from 'competent' textbooks is that there are no principles of measurement.[2]

Opinion as to the nature of measurement may be divided roughly into two categories. On the one hand, there are those writers (few psychologists or psychological philosophers are found in this group) who maintain that only those dimensions which permit a physical operation of addition are measurable. On the other hand, there is a small but prolific group (physicists or physical science philosophers are rarely found in this group) who deny that this is a requirement for a measurable dimension. Following Stevens[3] we will refer to the former as the "narrow view" and to the latter as the "broad view." However, we use these labels as a shorthand description of the two views, not in any pejorative sense.

Several broad views of measurement may be distinguished but the differences among the writers in the broad view are much less than the difference between the two groups. Stevens is probably both the broadest and the most prolific writer on measurements.

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[2]Norman R. Campbell, "Measurement and Its Importance for Philosophy," Aristotelian Society Supplement, Vol. 17, 1938, p. 121.

[3]"...some practitioners of the physical sciences prefer to cling to the narrower view..."
S. S. Stevens, "Measurement, Psychophysics and Utility" in Churchman, Measurement: Definitions and Theories, p. 19.

Hempel differs in some fundamental, some minor, ways but still may be classified as broad.

By contrast, differences among those writers who hold the narrow view are of a minor, often minuscule, character. We can say with little fear of distortion that there is only one narrow view of measurement. N. R. Campbell is the architect of this view and probably the most important single writer on the subject. The fundamental treatise is his Physics: The Elements. Other writers who follow him are Nagel, Bergman, Pap, Guild, Caws and a host of others.

Resolution of this debate is beyond the scope of this study and also beyond the ability of the author. One is tempted to plague both their houses. The broad view is sometimes so broad that it fails to offer any distinction between measurement and a host of other activities while the narrow view is sometimes so narrow that it would exclude every dimension except length and weight. For example, Stevens holds that "...the assignment of numerals[4] to objects or events according to rule--any rule" is a

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[4]In another context, Stevens says: "Measurement is...in its broadest sense...the assignment of numerals to objects or events, according to rules." S. S. Stevens, "Mathematics, Measurements and Psychophysics," Handbook of Experimental Psychology, ed., S. S. Stevens (New York: John Wiley & Sons, 1951), p. 23a.
Campbell says: "Measurement is the process of assigning numbers to represent quantities...." Norman R. Campbell, Physics: The Elements (Cambridge: Cambridge University

measurement.[5] Upon first encounter with this definition it is tempting to present a reductio ad absurdum rule and ask Stevens if the results are measurements. This would be of no effect, however, because Stevens lists as examples of "measurements" things that are intuitively absurd. It is quite likely that everyone who has not been influenced by Stevens would agree that it is absurd to call the numbering of football players a measurement. It violates a well-worn, if ill-defined, linguistic concept that is common to almost all members of the community. Yet Stevens lists the "numbering of football players" as a measurement on a

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Press, 1920), p. 267.

The strongest reason for saying that measurement is the assignment of numbers, rather than numerals, has been nicely stated by Hempel. He says that "quantitative or metrical concepts or briefly quantities...attribute to each item in their domain of applicability a certain real number, the value of the quantity of that item." In a footnote to this passage, he points out that it would be improper to speak of the attribution of numerals, rather than numbers, for the following reason:

> "...the values of quantitative concepts have to be construed so as to be able to enter into mathematical relationships with each other, such as those expressed by Newton's law of gravitation, the laws of mathematical pendulum, Boyle's law, etc.; ...and all these operations apply to numbers, not to numerals. Similarly, it is impossible to speak significantly of the distance, or difference, of two numerals."

C. G. Hempel, "Fundamentals of Concept Formation in Empirical Science," International Encyclopedia of Unified Science, Vol. II, No. 7 (Chicago: The University of Chicago Press, 1952). The text reference is to page 55. The footnote, footnote 61, is found on page 85. We will ignore this nicety and use the two terms interchangeably in this work.

[5]Stevens in Churchman, Measurement: Definitions and Theories, p. 19, emphasis supplied.

"nominal scale."[6]

Stevens notes our objection but he implies that it is of no importance.

> The nominal scale is a primitive form, and quite naturally there are many who would urge that it is absurd to attribute to this process of assigning numerals the dignity implied by the term measurement. Certainly there can be no quarrel with this objection, for the naming of things is an arbitrary business. However we christen it, the use of numerals as names for classes is an example of the 'assignment of numerals according to rule.'[7]

But the absurdity objection is important. We hesitate to call a nominal scale one of measurement, in either scientific or ordinary parlance, because its values do not represent the order or rank of the objects scaled. To assign numerals to football players is simply to give them convenient names. Surely measuring is to be distinguished from naming. If not, the author is reminded of Charlie Brown's new neighbors who were named numbers. If Lucy was familiar with Stevens' work she could say that the mother measured the children. One child was measured twenty-three, all were measured numbers. The substitution of "named"

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[6]Stevens in Churchman, Measurement: Definitions and Theories, p. 25, Table I.

[7]S. S. Stevens, "Mathematics, Measurement and Psychophysics," Handbook of Experimental Psychology, ed., S. S. Stevens (New York: John Wiley & Sons, 1951), p. 26a, and S. S. Stevens, "On the Theory of Scales and Measurement," Science, Vol. 103, 1946, p. 679a.

for "measured" is required before the preceding sentence makes sense. Surely "measured" and "named" are not synonyms regardless of how hard Mr. Stevens tries to make them so.

A common method of coding is to substitute numbers for names according to a rule. Under the nominal scale this is a measurement but of what dimension? What dimension does the Social Security Office measure? Stevens says that

> The oft-debated question whether the process of classification underlying the nominal scale constitutes measurement is one of those semantic issues that depends upon taste.[8]

The dimension question shows this is not true. Stevens' definition is useless in addressing the question of which dimensions are measured and which dimensions are capable of being measured. Whether a given definition has this important use is neither a "semantic issue" nor a "matter of taste."

Except for Stevens' nominal scale,[9] all writers agree that some dimensions (properties, characteristics) can be measured and that some cannot. All agree that weight and length can be measured and that shape and color cannot. Shape cannot be measured because objects cannot be ranked or ordered with respect to

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[8]Stevens in Churchman, Measurement: Definitions and Theories, p. 25.

[9]His other scales--Ordinal, Interval, Ratio--meet the requirement of ranking objects in a dimension.

shape. We can say that X is less than, greater than, or equal to Y in the dimension of length; but we cannot meaningfully say that X is less than, greater than, or equal to Y in shape.[10]

Color is similar although a little more complex. We can say that an object is redder than, less red than, or equal in redness to another red object, but we cannot meaningfully say that a red object is redder than, etc., a blue or green object. One requirement then for a measurable dimension and one on which all writers agree is that object in the dimension must be capable of being ordered, ranked. The explanation for this, presumably, is that in measuring the objects in a dimension we wish to express their relation to one another in that dimension in degree numerically.

There are, however, many dimensions, the objects of which are capable of being ordered, which many writers would

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[10]They may be "identical" or "congruent" but not "equal" in the usual linguistic usage. Whorf argues that this is a restriction on both our thinking and communication that is caused by the structure of our language. See in particular, "Thinking in Primitive Communities" for his hypothesis on comparitive aspects of language.

"We even have to think and boggle over the question for some time, or have it explained to us, before we can see the difference in the relationships...whereas the Hopi discriminates these relationships with effortless ease, for the forms of his speech have accustomed him to doing so." B. L. Whorf, Language, Thought, and Reality (New York: John Wiley & Sons, 1956), p. 85.

In this paper, we take the language as a given constraint, and while we may envy the Hopi his verbal ability to relate, our language requires numbers to make such relationships. Thus, shape is either identical or different, and such either/or concepts are not rankings, although they may be comparisons.

deny to be measurable. Consider, for instance, hardness, density, pitch, sweetness, etc. For each of these dimensions we can meaningfully say that the objects are greater than, less than, and equal to one another, and we can assign numbers to the objects in those dimensions to represent their relative magnitude. Moh's scale of hardness of minerals is a system for such assignment. Mineral X is said to be harder than Y if X scratches Y; X is said to be equal to Y if neither scratches the other and if X and Y scratch and are scratched by the same minerals. Ten minerals of unequal hardness are selected and ranked, and labelled 1, 2, ..., 10. A number can then be assigned to any other mineral by comparing it with the scale. The numbers thus assigned will represent relative hardness.

Many writers (the narrow view) maintain that the above procedure cannot be regarded as measurement for roughly the following reasons. Although X receives the number 1 and Y the number 2, we may not infer from this that Y is twice as hard as X. In general, ratio comparisons of this kind are meaningless when numerals are assigned by procedures like that involved in Mohs' scale. This can be seen from the fact that letters of the alphabet--which have an understood order--could have been used instead of numbers; and from the fact that the choice of numbers for the scale was arbitrary. Instead of 1 through 10, 1, 10, 100, ...1,000,000,000 might have been used, although this would have been more cumbersome.

Although we can admit that the lack of ratio comparisons is a serious limitation of Mohs' scale, we must also appreciate that an ordinal scale is an extremely useful conception. We will freely admit that a cardinal scale is more useful but to exclude the ordinal scale simply because it is less useful seems to be an arbitrary classification of those concepts which can be termed "measurement." A strong argument can be made that one has the right to define any word any way he chooses as long as he makes that definition explicit. That is, the definition of measurement is a "matter of taste." On the other hand, this approach is likely to cause serious difficulties in inter-personal communications. If everyone has a unique definition, the convenience of using a single label--word--for a complex abstraction has been lost. In addition, a different referent for the same word is almost certain to cause misunderstanding no matter how carefully the definitions are drawn.

In the following analysis we will assiduously avoid the definitional dispute. We will present some germane propositions of measurement which all writers would accept in spirit if not in detail. Criticism of our propositions, in the language of the logician, would be that they are necessary but not sufficient. The narrow school would accept each proposition as necessary to measurement but they would say that the set of propositions was insufficient because it did not include the additive axiom. The broad school would likewise accept the propositions but criticize

the set as being insufficient because it does not include the nominal scale.

In a later section we will present some more specific characteristics of measurement. That section will include a discussion of the additive axiom, not as a general requirement for measurement, but as that axiom relates specifically to the measurement of income. In this fashion we can have the best of both worlds; we can avoid a dispute that would lead us far astray while at the same time utilizing the concept that is the basis of that dispute.

General Propositions of Measurement

> I often say that when you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure it, your knowledge is of a meager and unsatisfactory kind. Lord Kilvan[11]

The objective of metrics has been well put by Lord Kilvan. We can all agree that our knowledge is richer, more satisfactory when we can express it in numbers. Or, in terms of the above discussion, our information is more informative if it can be expressed as a measurement. The purpose is clear: measurements make information more informative, but the interesting questions

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[11]Quoted by H. T. Davis, The Theory of Econometrics (Bloomington, Ind.: Principia Press, 1941), pp. 2-3.

are yet to come. What are the characteristics of measurement that give it this higher status?

Churchman answers this question in one context in terms of "precision."

> The contrast between quantitative and non-quantitative seems to imply a contrast between "precise" and "vague" information. Precise information is information that enables one to distinguish objects and their properties to some arbitrarily assigned degree of refinement...the reason that precision is useful is that precise information can be used in a wide variety of problems.[12]

Churchman's concern appears to be with precision. Notice, however, that precision is a second order concern. More fundamental is enabling "one to distinguish objects and their properties." Obviously, if there was no need to distinguish, there would be no need to distinguish precisely. Thus, the more fundamental aspect of measurement is its concern with the distinction between properties, characteristics of objects.

In more general terms, measurement is a process of comparison. We say that objects are longer, heavier, more resistant, etc., than other objects. We use the comparative form of the words in order to distinguish certain properties, characteristics of objects. This basic and simple-minded fact is sometimes overlooked because the results of measurement are ordinarily

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[12]Churchman, Measurement: Definitions and Theories, pp. 83-84.

stated in a positive form of speech. The very fact that we tend to forget that it is a comparison is testimony to its conceptual significance. "Three feet long" brings forth an image that is so definite that we think of it as a positive, black or white, description. Upon reflection, however, it is obvious that the statement is a comparison: more importantly, it is a general comparison. It means that this rod is longer than all objects that are less than three feet, equal to all objects that are exactly three feet, and shorter than all objects that are greater than three feet. Thus, the fundamental purpose of measurement is to allow us to distinguish, discriminate, compare, objects. For convenience, we call this the comparative proposition.

Measurement Proposition 1: The purpose of measurement is to relate, order, compare objects, events, to other objects, events.

Comparison of objects can be achieved in many different ways. The examination of any particular object will reveal a multitude of properties, characteristics that can be utilized to discriminate between that object and others. It will have length, volume, color, density, hardness, sweetness, shape, etc., any one or all of which can be utilized to compare. Even the simplest of objects possess a bewildering array of different characteristics and the <u>complete</u> description of all these characteristics may be well nigh impossible. An attempt to describe <u>all</u> the character-

istics of, say, a simple stone would require an enormous amount of time and effort.

Ordinarily, however, all the characteristics of any particular object are not desired. The comparison is made between only certain selected characteristics of the objects. The purpose of the comparison will determine which characteristics should be measured and which should be ignored. Crusoe's problem of finding a flagstone to fit his hearth specified the characteristics that were relevant. Shape, length and perhaps smoothness were relevant characteristics. Sweetness, specific gravity, carbon half-life and perhaps color were not. But, our discussion overlaps. The selection of the characteristic to be measured employs the same relevancy criterion as the selection of the binit to be transmitted. The metrician has a problem and that problem, along with the theoretical construct for its solution, specifies which characteristic should be measured.

The primacy of the theory, construct, conception is stated by almost all investigators of the subject of measurement. It becomes even clearer here than in the writings on information. Churchman refers to the efficient use of the information in "any problem-situation"[13] and in another context the generation of "a

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[13]"The scaling of a property of an object provides information as to the most efficient use of that property in any problem-situation." C. West Churchman, "A Materialist Theory of Measurement" in Philosophy for the Future, eds., Sellars, McGill and Farber (New York: MacMillan, 1949), p. 490.

class of information that will be useful in a wide variety of problems " (Supra). Stevens, who has several fundamental disagreements with Churchman, is in complete agreement on this point. He puts the question as "What purposes are we trying to serve?"[14] instead of referring to the solution of problems, but the difference is only in the choice of words. The purpose served is clearly the solution of a problematic situation.

But all of this has been said in the information chapter. The construct provides the criterion of relevance for the metrician in the same manner as it did for the transmitter. In addition, however, in measurement theory the construct performs the indispensable service of describing, explaining the dimension (property, characteristic) that is to be measured. As Cassier puts it, all measurements must be "conceived and sought."[15]

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[14]"As I see this issue, there can surely be no objection to anyone computing any statistic that suits his fancy, regardless of where the numbers came from in the first place. Our freedom to calculate must remain as firm as our freedom to speak. The only question of substantial interest concerns the use to which the calculated statistic is intended. What purposes are we trying to serve?" Stevens in Churchman, Measurement: Definitions and Theories, p. 29.

[15]Quoted by Peter Caws, "Definition and Measurement in Physics" in Churchman, Measurement: Definitions and Theories, p. 8. Caws presents a cogent argument for the prior conception notion: "This (operationism) is a neat solution to the problem of the identity of the measured and the defined, since the same operation serves for both purposes. But it leaves the problem of the nature of what is measured and defined untouched. Suppose we measure a length by the familiar device of putting a standard measuring rod against it, and obtain a numerical result; does this tell us

That is, we do not discover dimensions, we mentally conceive them and then seek to perform an operation which allows us to express that conception as a measurement.[16] The conception of the dimension is fundamental. One cannot measure an unconceived dimension. The juxtaposition of a meter stick to an object in the absence of a conception of the dimension of length would be pointless. There are philosophical disputes over the existence of a dimension prior to its conception--some say that a dimension does not "exist" until it is "conceived" while others argue that the conception was simply a "discovery" of a pre-existing dimension--but this is not germane. It is plain that one cannot seek an expression of something that he has not conceived.

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anything about length as such? What it does yield is something that may be called "specific length," by analogy with specific gravity; but when the process is complete we know nothing about length as it applies to the case in question that we did not know about it as it applied to the standard measuring rod that we used. We would know something about length operationally only if the measuring rod itself had no length. ...one first has a concept of some quality and looks afterward for quantitative expressions of it." (p. 8)

[16]Guild refers to a creation of a magnitude instead of a conception: "It is probably usual to regard the experimental processes of determining equality and of adding as something which we have just found to be a convenient method of determining quantitative relations inherent in the nature of the magnitudes, whereas the processes are the necessary connecting links between phenomena and number without which there would be no basis of comparison between the laws of the former and those of the latter. The experimental criteria do not merely enable us to measure a magnitude, they create the magnitude by defying the fundamental relations which are to be the basis of the classification." (Ferguson, p. 298)

The "definition of the fundamental relation" is a mental

Of course numbers can be generated for a wide variety of things, some of which may be quite abstract and difficult to describe. Length is a conception common to almost everyone and thus "two yards" brings forth an immediate mental image. Entropy is not so common, and therefore a measurement of entropy would be totally meaningless to many people. It requires extended explanation of the constructs of physics before entropy brings forth any kind of mental image, much less a meaningful mental image.

Measurement is concerned with a process of comparing, ranking, ordering, objects in a dimension. Obviously, the dimension must be amenable to comparison or we cannot measure it. More fundamental is the conception, the definition of the dimension. "Dimension" is a convenient name for a mental construct of a relevant property of an object.

Measurement Proposition 2: The construction and definition of a dimension is a prerequisite to the operation of measurement.

Given the conceived dimension we can then relate, compare objects to objects with respect to that dimension. We can align one object to another and discover which is longer without further refinements. This is a crude form of comparison

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conception which must come prior to the operation. "Create" seems to be tantamount to "conceive."

however, and, further, it is only a specific relation of one object to another. In order to make the comparison general, we need a unit of measurement; in order to refine the degree of discrimination, we need to make use of numbers.

The operation of measurement involves the comparison of the object to a unit of measure. The purpose is to facilitate the comparison of the object to other objects in the specified dimension. In other words, the use of a unit makes the comparison general. By going through the medium of a unit, by expressing the relevant dimension of the object in terms of units, we can relate this object to all others that have been, or will be, measured. Units allow one to make what appears to be a positive, purely descriptive statement about an object but which is, in reality, a comparative statement that can be used in a wide variety of circumstances. An ordinal scale of measurement can be established for a class of objects without the units, but this type of scale has the deficiency of the non-comparability of a particular object in one class with an object from another class. For example, we can create an ordinal scale by saying that A is greater than B in some dimension. Likewise, we can say that X is greater than Y in the same dimension. However, this does not permit the comparison of X to A. We have no idea what the relation of X to A is in this kind of ordinal measurement. By contrast, if both X and A are stated in "units," comparison can be made even though they belong to different classes. Thus, the benefit of utilizing a unit

is that it generalizes the results of measurements.

One requirement of a unit is that it "possess" the same dimension as the object. For example, an inch has the dimension of length, a pound the dimension of weight, etc. Without this characteristic, it would be impossible to compare the object to the unit. The possession of the dimension, however, implies nothing about the interval of that unit. The original establishment of a unit is quite arbitrary and no particular unit has any claim to being more proper or correct than any other. The origin of the length unit may have been a King's nose, or a light wave, and although the latter may appear to be more scientific, because it is more esoteric, and the former more humorous, both have equal claim to the title "unit."

Moreover, the different units may be used interchangeably by the process of measuring one in terms of the other. The resulting relationship is called, in metrics theory, a "transformation function."[17] For example, the transformation function of yards

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[17]Suppes distinguishes three separate transformations. "A real-valued function ϕ is a similarity transformation if there is a positive number α such that for every real number x

$$\phi(x) = \alpha x .$$

In transforming from pounds to grams, for instance, the multiplicative factor α is 453.6.

A real-valued function ϕ is a linear transformation if there are numbers α and β with $\alpha > \phi$ such that for every number x

$$\phi(x) = \alpha x + \beta.$$

In transforming from Centrigrade to Fahrenheit degrees of

to feet is the numeral "three," from inches to centimeters, 2.54, etc. It is true that one unit system may be easier to work with, such as metric versus English, but this easiness is due to the decimal base of the number system rather than a property of the units.

Although the origin of a unit is arbitrary, the subsequent selection must be done with some care if the use of the measurement is to be generalized. Wide use of a measurement by different people requires familiarity with the unit in which the measurement is expressed. For example, most English-speaking people use the English System of inches, feet, yards, etc. To these people, a measurement expressed in meters is meaningless. They must discover the length of a meter before they can compare the object to the other objects. That is, until they relate, compare meters to something in their own experience (feet, yards) the informational value of the measurement is nil.

The purpose of units is to make the objects comparable to all other objects in the specified dimension, i.e., to make the

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temperature, for instance, $\alpha = \frac{9}{5}$ and $\beta = 32$.

A real-valued function ϕ is a monotone increasing transformation if, for any two numbers x and y, if $x < y$, then $\phi(x) < \phi(y)$. Such transformations are also called order-preserving."
Patrick Suppes, "Measurement, Empirical Meaning Fullness, and Three-Valued Logic," in Churchman, Measurement: Definitions and Theories, p. 131, footnote 2.

We utilize the general notion of similarity transformation without this refinement.

measurement general. If we want to expand the generality of measurements to different classes of users of the data, the unit selected must be one that is familiar to those users.

Measurement Proposition 3: Units allow a general comparison of objects. A familiar unit allows a general use of measurements by different people.

The comparison of the object to the unit usually results in a statement of numerosity. The reason for the use of numbers is (1) to gain a greater degree of refinement in discriminating between objects and (2) convenience.

Parts of speech contain only three classifications--positive, comparative and superlative--which permit only the crudest of comparisons. Using only these parts of speech we could only identify the two extremes. For example, we could point out only the shortest and the longest in a given set of rods. All the others could be described only in the comparative form--longer than the shortest, shorter than the longest--which permits little discrimination.

By setting up a verbal classification, it is possible to make finer distinctions. The Beaufort scale is an example. "Gentle breeze" is less than "Moderate breeze" which is less than "Fresh breeze," etc. Such verbal classifications have

several unfortunate characteristics.[18] First, each dimension measured requires the establishment and definition of a new

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[18]Hempel describes the advantages of quantitative concepts in more detail:

(a) By means of ordering or metrical concepts, it is often possible to differentiate among instances which are lumped together in a given classification; in this sense a system of quantitative terms provides a greater descriptive flexibility and subtlety. Thus, e.g., the essentially classificatory wind scale of Beaufort distinguished wind strengths: calm, light air, light breeze, gentle breeze, moderate breeze, fresh breeze, etc., which are defined by such criteria as smoke rising vertically, ripples on the surface of the water, white caps on the waves, etc. A corresponding quantitative concept is that of wind speed in miles per hour, which plainly permits subtler differentiations and which, in addition, covers all possible instances, whereas the Beaufort classes are not necessarily mutually exclusive and exhaustive of all possibilities. Now, the descriptive subtlety of a classificatory schema may be enhanced by the construction of narrower sub-classes; but this possibility does not change the basic fact that the number of distinctions must remain limited. Besides, such subdivision requires the introduction of new terms for the various cases to be distinguished--an inconvenience which is avoided by metrical concepts.

(b) A characterization of several items by means of a quantitative concept shows their relative position in the order represented by that concept; thus, a wind of 30 miles per hour is stronger than one of 18 miles per hour. Qualitative characterizations, such as 'gentle breeze' and 'moderate breeze,' indicate no such relationship. This advantage of quantitative concepts is closely related to that obtained by the use of numerals rather than proper names in naming streets and houses; numerals indicate spatial relationships which are not reflected by proper names.

(c) Greater descriptive flexibility also makes for greater flexibility in the formulation of general laws. Thus, e.g., by means of classificatory terms, we might formulate laws such as this: 'When iron is warm, it is gray; when it gets hot, it turns red; and when it gets very hot, it turns white,' whereas with the help of ordering terms of the metrical type it is possible to formulate vastly more subtle and precise laws which express the energy of radiation in different wave lengths as a mathematical function of the temperature.

Carl G. Hempel, "Fundamentals of Concept Formation in Empirical

classification. Not only does this require time and effort of the metrician, it also limits the users of the measurements to those who have taken the trouble to learn the classifications. Second, any refinement of the classification requires the introduction of new terms. Very fine gradations become cumbersome. Third, each classification fails to discriminate between items within that classification, although there may be a relatively large deviation, and at the same time makes very fine distinctions at the boundaries of each classification, often without adequate criteria for making that distinction.

Numerosity of units do not have such limitations. Only one classification--the unit--is necessary. Beyond that the general number scheme can be utilized for all units in all dimensions. Thus, one attribute of numerosity is its convenience. More importantly, however, is the infinitely fine gradation available in the number scheme. Numbers can be fractionalized to any desired degree. If the unit is subject to fractionalization, a measurement expressed in numbers can be carried to any degree of precision. The limitations of precision, when numbers are used, is a result of the limited perception of the metrician and/or the limitation of the instrument; it is not due to any characteristic of numbers.

Science," International Encyclopedia of Unified Science, Vol. II, No. 7; 1952, pp. 56-7.

Measurement Proposition 4: The use of numbers is more convenient and permits a higher degree of precision than a verbal classification scheme.

The operation, procedure of measurement has for its purpose the placement of a given object in a dimensional scale. The purpose of the operation has nothing to do with instrumentation, precision or specification of procedure. There may be a variety of different instruments and procedures available to measure any particular object but the selection of the instrument is not germane to the purpose. Weight may be measured by the use of several different kinds of instruments each of which require a different procedure. However, in each case the desired end is to discover, by means of the procedure and instrument the number of pounds, grams, etc., that the object possesses. Once the numerosity of units has been discovered the object has then been related to all other objects in this dimensional scale through the medium of the number of units.

This is a fundamental disagreement with the rather common statement that measurement is the assignment of numbers to an object. Assignment is much too broad a term in describing operations of measurement. One can assign numbers to objects

by means of a table of random numbers.[19] One can mentally project any number to any object in a capricious and arbitrary fashion. Such a projection, assignment cannot be called a measurement because it does not discriminate between objects in any dimension. We do not deny that the dimension is a mental conception and that the units are arbitrary. However, once this dimension has been conceived and the units defined, the objects then possess a certain number of those dimension units and the purpose is to discover that number.

We have a well-defined conception of the dimension of length and several (arbitrary) units. Given the conception and unit, it makes no sense to speak of assigning numbers to a rod unless we agree to use the word in a rather peculiar fashion.

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[19]Stevens asserts that random assignment is not according to a rule.

This is quite different from a "random" assignment under which no rule would be in force. With no rule in force, the same numeral might be assigned to different classes, and different numerals might be assigned to the same class. A class in this sense may, of course, contain only one member, as when the coach "numbers" his football players.
Stevens in Churchman, Measurement: Definitions and Theories, p. 25-6.

It appears that Mr. Stevens has defined measurement in such a fashion that it shifts the argument from one over "measurement" to one over "rules." One could formulate the following:

"Assign numbers to this object by a random selection."

The question now is whether the above is a "rule." Stevens says no but he fails to define a rule. Measurement is thus defined by using an undefined term and if we follow the definition we would find ourselves arguing over "rules" instead of "measurements."

Discovery is a much more apposite term because that is what the operation accomplishes; it discovers, reveals the numerosity of the dimension units in that rod. Of course, we could agree to use assign in conjunction with the word operation--"assign numbers in accordance with a specified operation"--and this would mean the same thing. For example, we could say "assign the number to this object equal to that number of weights that is required to make this scale balance." However, the purpose of this operation is abundantly clear. It is to discover the number of weights that are required to make the scale balance. The object has the dimension of weight, there is an extant condition of that object, and the operation reveals a numerosity of units that allows us to compare it to other objects.

Precisely the same thing is true in an ordinal scale. For example, in Moh's scale of hardness certain minerals have been selected as basic referents and assigned numbers. (We assign numbers to a scale, we discover the numerosity of units in an object.) These minerals and their corresponding (assigned) numbers constitute a scale of the dimension of hardness. The units in such a scale lack certain attributes that other (additive) units possess but that is not pertinent at the moment. Given the preconceived notion of hardness and the arbitrarily contructed units, the purpose of an operation of a measure of hardness by Moh's test is to discover the proper placement of an object in a preassigned numerical scale. Suppose that objects X and Y have been

assigned the numerals 1 and 2 in Moh's scale. If we measure mineral Z by the operation of scratching and find that it scratches X and is scratched by Y we have discovered its place on Moh's scale; it belongs between 1 and 2. The exact point between 1 and 2 is not known but the operation discovered, albeit imprecisely, the place in the scale where the object belonged.

Of course, one can point out that letters of the alphabet--which have an understood order--could have been used instead of numbers. Because of the fact some metricians argue that Moh's scale is not properly called a measurement. We will not join in this dispute; our point is much less subtle: Given the fact that numbers are used, the operation discovers the particular number (or range of numbers) that describe the object's place in the scale. The object has an extant condition, the operation discovers that condition.

Measurement Proposition 4: The purpose of the operation of measurement is to discover the proper placement of a given object in a given scale. The general statement of placement is in terms of numerosity of units.

Summary

The purpose of measurement is to make information more informative. Given the premise of Criterion I, it follows that, if

possible, we should utilize the concept and procedure of measurement in this study. Our basic purpose is to provide information and measurement provides more information; therefore, we should measure.

The manner in which measurements increase our information is quite different from the relevance criterion. Relevance remains the sine qua non of information. An irrelevant measurement is not "information" as we have defined it. We noted that measurements were "conceived and sought" and the reason they are sought is precisely because they are relevant. Given the requisite of relevance the question remains: Why are relevant measurements more informative than relevant non-measurements?

A review of measurement theory reveals two apparently self-contradictory attributes which make measurements more informative: They are both more general and more precise at the same time. More general because we can relate any object to all other objects by utilizing the medium of units. More precise because we can refine our discriminatory powers by expressing the units in degree numerically.

The concept of measurement may be outlined as four temporally ordered steps.

1. The conception of a dimension (because this dimension is relevant to some problematic situation).
2. Definition of the units of the dimension.

3. Agreement to express the units numerically.
4. Description and application of an operation which discovers the numerosity of units in a given object.

The operation, procedure of measurement occurs in the reverse order. This may be visualized in Figure 7. Two objects, A and B, are found on the plane in a random, non-ordered position. An operation is performed which discovers the numerosity of the units of the objects. The units are ranked, ordered according to the general number system along the vertical axis. This relation of objects to units allows us to conceptually order the objects in the conceived dimension along the horizontal axis.

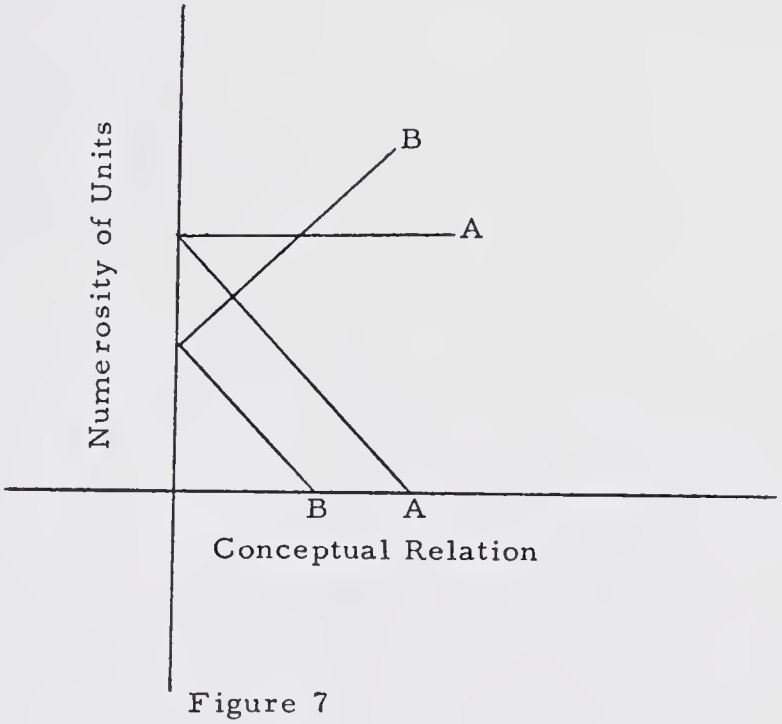

Figure 7

Of course, the two objects, A and B, could be ordered one to the other without going through the units. However, if at a later time we wanted to add C to our conceptual order we would be forced to compare it to both A and B before placing it on the scale. Then if D were added the same process would be required and perhaps one of the earlier placements would have to be shifted. In a very short time this would become cumbersome. Thus, the units perform the function of generalizing the relationship of objects to objects. They relate all objects to all other objects.

In addition, units generalize the comparison in another direction. To communicate the fact that "A is greater than B" presupposes that the receiver knows the size of B; "A is greater than B and less than C" presupposes that he knows the size of both B and C. If the receiver does not know the size of the referent objects, there can be no conceptual ordering. The use of a unit permits all receivers who have knowledge of the size of the unit to make the generalized comparison.

The use of numbers is a convenient method of ordering magnitudes that is common to almost all members of the community. Moreover, if the unit is subject to fractionalization, the use of numbers allows us to state the magnitude in a degree of precision that is limited only by our perception of the magnitude. Thus, under ideal conditions of measurement each object would have a unique place on the horizontal axis and the distance between the placements would be conceptually significant.

The advantages of expressing income as a measurement are the same as those of any other magnitude: it permits a generalized, precise, convenient, conceptual ordering of a relevant magnitude by all receivers who are familiar with the dimension and unit. The accomplishment of this goal has several prerequisites. We must

1. Conceive and describe the dimension.
2. Discover a familiar unit.
3. Define an operation which will allow us to discover the numerosity of the units.

These tasks are the subject of a subsequent chapter.

CHAPTER IV

MEASUREMENT (CONTINUED)

In the previous chapter we briefly outlined some general propositions of metric theory. There are several other characteristics of measurement that are germane to this study but are rather more specific than the propositions presented above. The purpose of this chapter is to review these characteristics.

Conditions Attending the Operation of Measurement

In the previous discussion we referred to the "operation" of measurement. Much of the metrics literature has been devoted to the necessity of carefully defining this operation (procedure) and a major dispute has arisen about the results of such a definition. We do not deny the importance of such a description nor do we wish to join in the controversy between the operationalists (often called operationists) and the non-operationalists. Our point is not that the description of operations is unimportant but that it is of less importance than the construct. In view of Stevens' statement about the "purpose served" and Guild's about the "creation of the magnitude" it appears that we have no fundamental disagreement with these operationalists.

However, Margenau observes that there are other philosophers and scientists who have an oversimplified view of the concept of measurement.

> Most philosophers and many scientists regard measurement as a simple "look-and-see" procedure, requiring at the most a careful description of apparatus and the recording of a number. In doing so, they ignore two things. First, the relevance of the number obtained, its reference to something that is to be measured, and its physical dimension. For the apparatus and the act alone do not tell us that the measured number represents a length, an energy, or a frequency; this identification involves the use of certain rules of correspondence with the preformed theoretical constructs which greatly complicates the meaning of measurement.[1]

Our disagreement is with these people--perhaps they should be called "extreme operationalists"--who seem to think that the description of the apparatus alone makes the reported figure meaningful, relevant.

More germane to this study is the following, not atypical, quotation.

> To the extent that the figures appearing on the report of earnings and the balance sheet are influenced by such decisions, they can be rendered at all meaningful only by the consistent treatment of like items and are fully understandable only if the underlying accounting policies are known.[2]

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[1]Henry Margenau, "Philosophical Problems Concerning the Meaning of Measurement in Physics," Measurement: Definitions and Theories, eds., C. West Churchman and Philburn Ratoosh (New York: John Wiley & Sons, Inc., 1959), pp. 164-65.

[2]Ronald H. Robnett, Thomas M. Hill and John A. Beckett,

The clear implication is that these figures will be rendered meaningful if the "apparatus" is carefully described and consistently applied. We disagree and again call upon Hempel's hage example as a refutation. No matter how carefully one describes the apparatus of measuring hage, nor how consistently it is applied, the results are completely irrelevant and therefore without value. The same is true for figures appearing on the balance sheet and income statement. The apparatus and the act alone do not render the figures meaningful or fully understandable.

The overemphasis (or misunderstanding) of the description of the operation should not blind us to its continued importance. Such description may help to clarify and sharpen our conception of the dimension. Children are often taught the conception of length by having them perform the simple operation of juxtaposition of rules. Wooden blocks help in the conception of area and volume. Moreover, the description may render measurements comparable or avoid errors. For example, the "C", "F", or "K" that appears in conjunction with temperature measurements is a description of the calibration of the instrument. Given the information one can adjust centigrade to Kelvin and make the figures comparable. Without the information the figures are either useless or, if one assumes that they are both in the same calibration, productive of

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Accounting: A Management Approach (Homewood, Illinois: Richard D. Irwin, Inc., 1951), p. 511.

errors.

On a more abstract level the need for the description of the general conditions attending a measure is self-evident; measurements always take place under different conditions. One cannot measure two different objects at the same time, in the same place, with the same instrument. Often these different conditions are of no consequence. The time difference may be so short that it can be ignored. Or, if the object is temporally invariant, a large time difference is an "irrelevant" condition. However, the shortness of the time interval or the temporal invariance of the object is an indispensable datum. One cannot legitimately "ignore" a time difference unless he knows that the distortion caused is negligible. When one "ignores" in this fashion he is implicitly making an adjustment of the data. It may be a zero adjustment, as in this case, or a similarity transformation (e.g., from Centigrade to Fahrenheit) in other cases. In any event the conditions under which the measurement was made must be known before the data can be utilized.

There are two ways of making the conditions known:

1. Standardize the conditions and report the standards.
2. Report the conditions with each measurement.

Churchman argues for the first alternative:

> The reason for standardized data is easy enough to give. Without standards, one would have to report all the relevant information about the time, place, persons, etc., in addition to the data report itself. Otherwise, no one would know what values to assign to the variables in the laws that enable one to use the report in other circumstances. But once a standard has been given, then all data reports can be adjusted to the standard, and all that is needed is the data report itself.[3]

In the terms of a previous chapter, Churchman is concerned with conserving channel capacity. If the standards are reported once they need not be repeated with each message. From the previous homely example, we could omit the "C", "F", or "K" from each transmission if we had previously reported that we would use, say, the Kelvin calibration for all measurements.

We are in complete agreement. Conservation of channel capacity is a commendable goal. However, there is a more fundamental reason for standardizing the conditions. Some measurements are not amenable to adjustment. Some do not have "laws that enable one to use the report in other circumstances." Objects that are not temporally invariant provide an example. There is no known method of weighing a person at 30 years of age and adjusting the data so that we can relate his weight at birth to other infants. In such cases the very purpose of the measurement is vitiated if the conditions are not standardized.

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[3]Churchman, Measurement: Definitions and Theories, p. 91.

Another disadvantage of non-standard measurements is the time and effort required to make the adjustment. There is a cost attached to adjustment and therefore minimum adjustment is a desideratum.

In summary, we note that the purpose of measurement is to make comparisons. In order for this purpose to be met the conditions of the measurement must be either standardized or amenable to adjustment. In some cases the former is merely preferable because it (1) conserves channel capacity and (2) minimizes costs. In other cases, standardization is essential because there is no known method of adjusting the data to make it comparable. Thus, there is a need for the standardization of conditions but this is not possible since no two measurements can be made under precisely the same conditions. For the variation in conditions that cannot be standardized, the only thing that can be done is to report, make known, the non-standard conditions so that the user of the data can either make adjustments or estimate the degree of non-comparability.

The notion of standardization is important to this study because of the argument about the uniformity of accounting principles. Critics of the present state of accounting have complained about the wide variations in method that are allowed in the measurement of income. They have urged that the method be standardized in order to make the data comparable. For the opposition,

the reply has been that uniformity would make accounting so rigid that experimentation would be prohibited. Experimentation is necessary to progress and therefore, so the argument goes, uniformity would prohibit progress. In addition, it is thought that a rigid method would not be applicable to all firms because each firm is different from all others. That is, the differences in the objects to be measured requires different methods of measurement. A third school attempts to ameliorate the dispute by allowing different methods but requiring that the method be disclosed in footnotes. Presumably, in this way, the reader can adjust the data to make it comparable.

Since standardization of data is at least a desideratum and may be essential, we applaud the efforts of those who have attempted to make the principles uniform. Accountants have long recognized the necessity of consistency of method within the firm and inter-firm uniformity is simply an extension of that rule. Intra-firm consistency is for the purpose of making the data comparable over time and inter-firm consistency would have the purpose of making them comparable among firms. We fail to see how consistency would inhibit progress. Theoretical advancements could still be made and then consistently implemented. Witness the consistent application of rigid rules by the National Income Bureau concurrent with theoretical refinements and periodic implementation of those refinements. The implementation of the refinements

always cause some disruption and require adjustments (splicing the series). However, the disruption is the result of the lack of consistency (changing method) and if there were continuous inconsistency, there would be continuous disruption. Inconsistency does not inhibit progress; it causes chaos.

The disclosure argument may be criticized on two grounds. First, the adjustments are costly. Fahrenheit requires effort before it can be compared to Centigrade and the continued use of both calibrations demands strong justification. We have not been convinced of the merits of different methods even if they are adjustable. Secondly, and more importantly, a complex method requires a complex adjustment. Most footnotes to financial statements are epigramatic generalizations about a very complicated method. They permit only the crudest kind of adjustment. For example, lifo cannot be adjusted to fifo, even by an experienced Certified Public Accountant, in the absence of the complete detail of the inventory records. For the average receiver a lifo-fifo comparison is utterly impossible even if he has the detailed inventory account. Thus, in many instances, the data are not adjustable and standardization is imperative. In all cases standardization is preferable.

We are in general agreement with the notion of uniformity of principles. However, there is a more fundamental requirement. The standard method must be one which reveals the numerosity of units in a relevant, preconceived dimension. Until this has been

accomplished, the argument over standardization is premature.

The Temporal Conditions of the Operation

For some measurements the dimension is conceived as the relation of two other dimensions. These are often called "dependent measurements" because they depend on the measurement of more "fundamental" dimensions. In physics, the dimensions of volume, pressure, length, time, force, number, angle, electrical resistance, current and voltage are classified as fundamental. Temperature, density, magnetic permeability, etc., are "derived" or "dependent" dimensions.[4] Density is often used to illustrate the distinction. The weight and volume of an object is measured and then expressed as a ratio (weight divided by volume). That is, the fundamental dimensions yield the derived dimension.[5] Like-

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[4]This is Campbell's classification. N. R. Campbell, "Measurement and Its Importance for Philosophy," Aristotelian Society Supplement, Vol. 17 (1938), pp. 126-127.

[5]For extended analysis of the dimension of density see e.g., Norman R. Campbell, Physics: The Elements (Cambridge: Cambridge University Press, 1920), pp. 275-7, 346-8; Morris R. Cohen and Ernest Nagel, An Introduction to Logic and Scientific Method (New York: Harcourt, Brace, and Co., 1934), pp. 218-301; Gustav Bergmann and K. Spence, "The Logic of Psychophysical Measurements," reprinted in Feigle & Brodbeck Readings in the Philosophy of Science (New York: Appleton-Century-Crofts, 1953), p. 108; Arthur Pap, An Introduction to the Philosophy of Science (New York: The Free Press of Glencoe, 1962), pp. 131-5; Guild in Ferguson, et al., "Quantitative Estimates J. Sensory Events," British Assoc. Advance. Sci., 108 (1939-40), pp. 298-9.

wise, temperature is considered derived because it depends on length,[6] speed is dependent on distance (length) and time.

Income falls into the category of a derived dimension because it is wealth change over time. A discussion of wealth is left for a subsequent chapter, but there are several attributes of time that are general to all measurements. Since income has this vital temporal dimension, we may profit from a general discussion of the relation of time to measurement.

Measurements may be two different kinds of comparisons as they relate to time: instantaneous or inter-temporal. One may wish to compare different objects at a given point in time or to compare the same object at different instants. The former, we define as "instantaneous," the latter as "inter-temporal."

Instantaneous measurement has for its purpose the ranking of objects at a specified moment. The operation has for its purpose the discovery of the units contained in an object. This operation occurs at a specified moment and that moment is either the "present" or in the past. It cannot be in the future, i.e., one cannot discover the future, one must predict. Thus, one requirement for an instantaneous comparison is that the temporal location of the operation be in the past. More important, however, is the requirement that the operation on all the objects be either performed

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[6]Campbell, Physics: The Elements, pp. 396-402; and Guild in A. Ferguson, et al., "Quantitative Estimates of Sensory Events," pp. 302-5 present lengthy and conflicting analysis of the measurement of temperature.

at the same instant or that the measurement be subject to adjustment. That is, if we wish to compare objects to objects, the temporal location of the operation must be standardized or there must be a known method for adjusting the data.

The most common adjustment for measurements taken at different times is zero. There are many objects that are temporally invariant and thus the time dimension is said to be "irrelevant," i.e., it requires a zero adjustment. The length of a steel rod is an example. Other things equal, a steel rod may be instantaneously compared to all other steel rods regardless of when the measurements are made. On the contrary, the length of organic objects are not normally temporally invariant and, therefore, unless they are amenable to adjustment, the measurement must be taken at the same time if an instantaneous comparison is desired.

If our purpose is to order, rank, two infants by weight, it would be absurd to weigh one in January and the other in July. The resulting figures would not permit us to rank their weight at any point in time. Since there is no known method of adjustment, the measurements are said to be "not comparable," i.e., useless, devoid of information. In the absence of a method of adjustment, the measurements must be taken at approximately the same time. We say "approximately" because the purpose of the measurement may allow for imprecision. For most purposes, we would ignore a difference of one second or one minute. We would probably

ignore a difference of one hour and perhaps even a difference of a week. However, any difference in time results in some degree of non-comparability and it would be desirable to have the measurements perfectly comparable.

There is another kind of comparison of objects to objects that allows the measurement to be taken at different times without adjustment. For example, we could specify that we wanted to rank the weight of the infants at birth, or at six weeks of age, or at the appearance of the first tooth, etc. Note, however, that these specifications, although they may be stated in terms of a "time," are concerned with an event. "Time of birth" in this instance really means "event of birth." In the case of such "event comparisons" the temporal location of the event is truly irrelevant. The temporal location of the measurement of an object that is temporally invariant is often said to be irrelevant (as we did above), but we consider it more appropriate to call that situation an "adjustment," albeit a zero adjustment, and to describe the temporal location of the measurement of an event comparison as irrelevant.

Measurement of the wealth of a firm is an instantaneous comparison. The desire for information arises at a specified instant; there is no particular event which triggers the measurement. If we wish to rank the wealth of two firms, the measurements must be made at (approximately) the same time because there is no known method of adjustment.

Inter-temporal comparisons have the purpose of ranking, ordering, a given object in a given dimension at two points in time. The procedure is the same as for instantaneous comparisons. One performs an operation for the purpose of discovering the numerosity of units at a given instant. The same operation is performed at another instant and the difference in numerosity allows us to rank the object in the dimension at two different times. Obviously the time interval must also be measured.

The distinction between the different types of comparisons may be presented visually. The reader will recall that in Figure 7 we found the objects in a random fashion and discovered the numerosity of units. By ranking the units we could then conceptually rank the objects. The last step--conceptual ranking of objects--is omitted from the following figures so that the axis may be used for another variable.

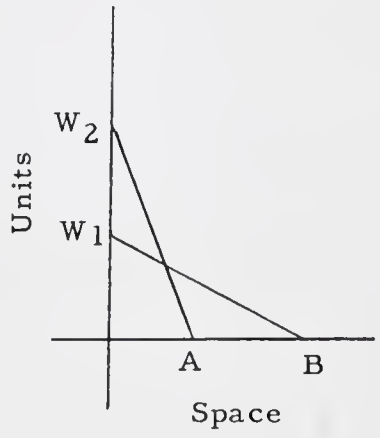

Figure 8a

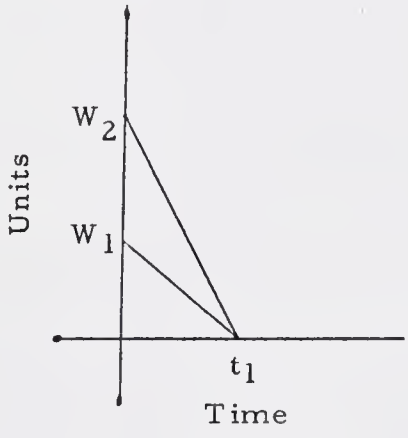

Figure 8b

Figure 8a illustrates the objects occupying two different places when the operation is performed. This spatial difference is either irrelevant or adjustable. In Figure 8b the numerosity of the units is shown being discovered at the same time.

The inter-temporal comparison may be visualized by reversing 8a and 8b (assuming that the objects occupy the same space over time).

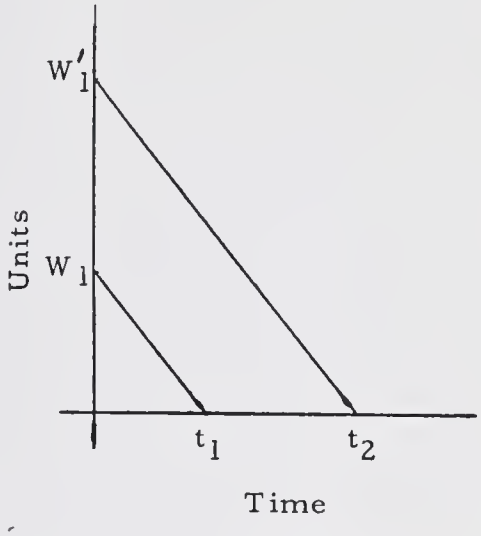

Figure 9a

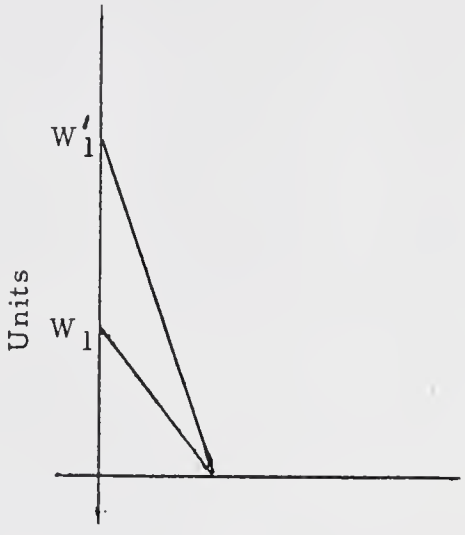

Figure 9b

The inter-temporal comparison is for the purpose of determining the increment (including negative increments, decrements) of the object. Given standard conditions and/or adjustability, a further comparison can be made, viz., the comparison of increments. That is, we can rank the increments of different objects.

In Figure 10 we have plotted the placement of two objects, A and B, at two different times t_1 and t_2, on a scale of, say,

weight in pounds against time. The distance from $A(t_1)$ to $A(t_2)$ is the increment, I_A, of units of the object over the time span. The same is true of $B(t_1)$ to $B(t_2)$.

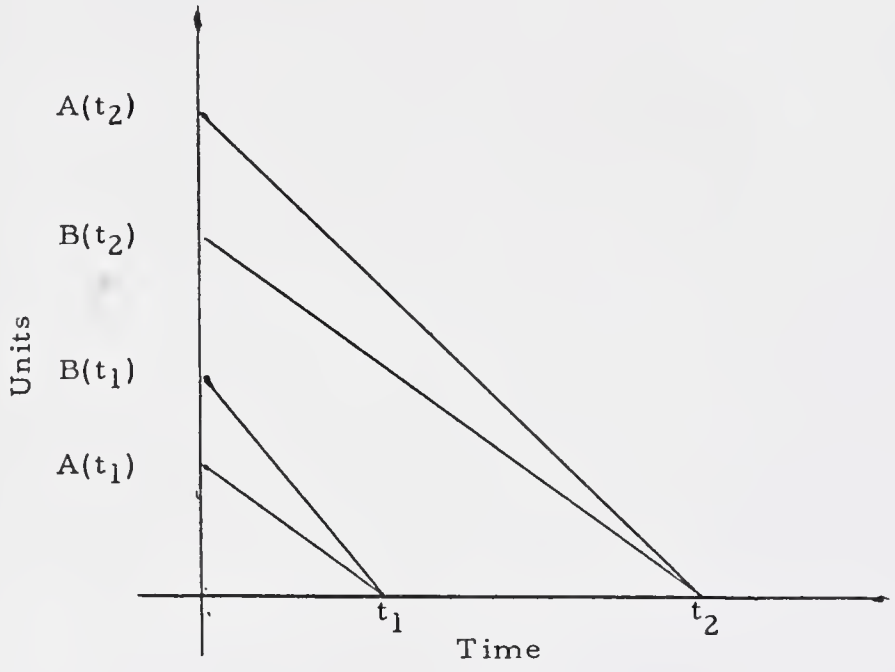

Figure 10

Given the standard conditions of the operations, these two increments can now be ranked in the same units, as shown in Figure 4. In this case there is no question about the comparability of I_A to I_B since the measurements were made at the same instants. In other cases we may standardize only the time interval rather than the time instants. This is inferior, however, because there may be different conditions prevailing at different times and thus some doubt about the comparability of the measurements. In addition, the standardized interval permits only the increment comparison

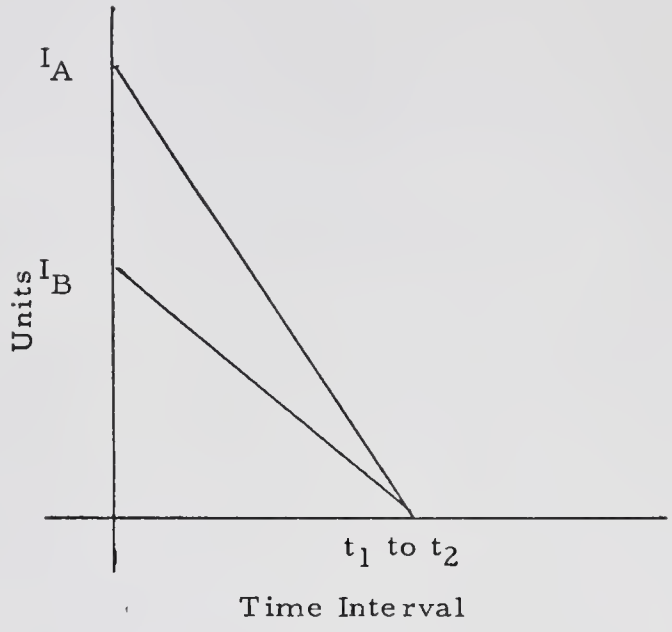

Figure 11

between the object while the standardized instants permit an instantaneous comparison as well. That is, there are five different comparisons that are possible:

1. A to B at t_1 (Instantaneous)
2. A to B at t_2 (Instantaneous)
3. A to A from t_1 to t_2 (Inter-temporal)
4. B to B from t_1 to t_2 (Inter-temporal)
5. (A to A) to (B to B) from t_1 to t_2 (Increment)

Standardized intervals permit (3), (4), and (5) if, and only if, the other conditions prevailing are adjustable. Standardized instants permit all five comparisons without adjustment.

This rather lengthy look at temporal conditions of measurement is particularly germane to this study. There are some

income metricians who are troubled by the existence of different prices at different times and places. They claim that prices cannot be utilized in their measurements because of these differences. Yet it is clear that income is an inter-temporal comparison and the measurement is for the purpose of discovering the difference in wealth over time. If there were no differences in wealth, and one requirement for such a difference is a price change, there would be no point in making the measurement. If wealth is temporally invariant, an inter-temporal comparison of wealth is pointless. Their claim is tantamount to saying that the weight-increment of infants is impossible to determine because their weight will change in the future.

The complaint is sometimes stated in terms of prices being only "momentary." May we point out that everything that is temporally variant has "only" a "momentary" number of units. That is the meaning of temporal variance. The number of units occurs only at a point in time and will change in the future. It is patently ridiculous to refuse to measure the variation of an object over time because it does vary over time when the purpose of the measurement is to discover the variation.

Other income metricians revert to an event-comparison. Specifically, they refuse to alter a previous measure until a transaction occurs. An event-comparison may be valuable information in some circumstances but it is quite different from an inter-temporal comparison. Time is irrelevant to event comparisons and

income is defined as the difference in wealth at two instants of time, not as the difference at two events. Thus, event-comparisons violate the generally accepted definition of income.

Measurements, Predictions and Retrodictions

We have noted that the operation of measurement is for the purpose of discovering an extant condition. The operation occurs at a given instant and discovers the condition that exists at that instant. The instant in which the operation is performed is always in the past (including the very near past, the "present"). One can plan to perform an operation in the future but one can only perform that operation now, in the present, which very soon becomes the past. Thus, all measurements are of past dimensions. This does not mean that the dimension did not exist previously or that it will not exist in the future. However, knowledge of the previous or future existence of a dimension requires an additional step beyond the operation of measurement. The original purpose of making the measurement may be to predict a future condition or retrodict a past condition but this does not negate the fact that measurement is of the extant and that predictions are of a fundamentally different nature.

For example, Crusoe's search for a flagstone contained a very simple prediction, viz., that the objects would remain spatially and temporally invariant. First, he measured the hearth

and then, in a different time and different place, he measured the flagstone. From this he predicted that the flagstone would fit the hearth. Obviously if the flagstone were temporally variant it would not fit the hearth. That is, his prediction would be wrong. Nevertheless, his measurement could have been correct, regardless of the correctness of his predictions.[7] The distinction may blur in practice but conceptually it is quite clear.

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[7]Churchman says that Crusoe "argues" that the hearth will fit the flagstone. We have said above that it requires an adjustment. The distinction between an adjustment and a prediction is basically temporal. A measurement (an expression of an extant property taken under some past conditions) is "adjusted" to make it comparable to a measurement taken under different conditions. The person hypothesizes that if the past conditions had been the same the measurement would have been some other amount. He says

> If measurement X had been taken under conditions Y, the result would have been Z instead of X.

This is a counterfactual-conditional or, if preferred, it is a retrodiction. It states what would have occurred in the past if the conditions had been Y.

A prediction, on the other hand, states what will be in the future. The temporal condition is important because it can be successfully argued that, cet. par., a retrodiction is more probable than a prediction. The proof of this statement may be briefly outlined as follows:

First, we can note that no "law" that permits either predictions or retrodictions is ever completely verified in the sense that the act has occurred. Goodman (Leonard Linsky, Semantics and the Philosophy of Language, Urbana, Ill.: University of Illinois Press, 1952, pp. 162-165) uses the simple example of heating butter.

> (1) If that butter is heated to 150°F., it will melt.
> (2) If that butter had been heated to 150°F., it would have melted.

(1) is a prediction and (2) is a retrodiction. They both involve the same "law" and that law has not been verified in the sense

If the dimension is temporally variant the distinction is thrown in clear relief. At t_1 we could measure the temperature of a given volume of liquid and discover that it was F_1. From our previous experience we can predict that the temperature will vary over time. In fact, under cet. par. conditions we can predict with almost complete certainty what the temperature will be in the future. A physicist will tell us that the temperature will equal the temperature of the air at t_n. The experiment has been verified so

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that all butter has been heated and the reaction observed. If it all had been heated the "law" would be useless because it is about non-existent things.

Given the lack of verification of the law we can argue that the law is "only" a probability statement, it is not certain that the butter would have or will melt every time that it could have been or will be heated. (Cf. C. D. Broad, "Probability and Induction," Mind 1918, 1920)

Second, there is no good reason to assume that the future will be like the past in all relevant respects. We usually do project the future on the basis of the past mainly because that is the only evidence we have but the assumption that the future will be like the past may be unwarranted. Keynes refers to this as the "uniformity of nature" projection (John M. Keynes, Treatise on Probability, London: MacMillan and Co., Ltd., 1948) and notes that the logical problems are unsurmountable. We quoted Russell's chicken example above which notes the same problem. Thus, we can say that a future projection is only a probability statement.

Third, any prediction is a combination of these probabilities. A prediction has an understood clause about the future.

> If this butter is heated to 150° and the world remains unchanged in all relevant respects, this butter will melt.

The retrodiction does not need the understood clause because it concerns the past and what has been is an empirical question. Since the prediction requires a second connected probability, regardless of how high that probability is, the probability of the outcome is less than that of a retrodiction.

often that we have a high degree of confidence that the outcome will equal our prediction. It has become a "law" of physics. Note, however, that this law is the result of a functional relationship between measurements. In the past someone measured the respective temperatures, time, surface exposed to the air, etc., and formally stated the temperature changes as a function of time. The measurements were the original raw data, the law is a method of projecting a future state-of-being. The prediction can be verified by another measurement when (and if) the future becomes the present.

Given the law-like characteristic of this prediction the fact that it is not a measurement is of little consequence in practical affairs. We would all be willing to act on the basis of this kind of prediction in the same manner as if it were a measurement. Indeed, we could even reverse the variables. By measuring the temperature change we could determine the elapsed time without an independent measurement. By measuring the elapsed time we could obtain the temperature change without a thermometer. Suppose, however, that we remove the cet. par. conditions. Assume that we take the liquid out of the laboratory and expose it to the normal atmosphere. This change does not invalidate the law, it simply renders it inoperable for the purpose of predicting a future temperature. The temperature of the liquid still depends upon, is a function of, the temperature of the air. If the air temperature

remains stable over sufficiently long periods the liquid temperature will equal it. However, the prediction can no longer be stated as a specific temperature (a number of units) at a given time. It is now stated as a relation: "The temperature of the liquid will tend to equal the temperature of the air." It will only "tend" because the air temperature may be quite volatile and may never remain stable long enough for the two to become equal. Moreover, the uncertainty about the future air temperature renders the future liquid temperature equally uncertain.

One possibility in this situation is to make a counterfactual conditional statement. As the name implies, this is an "if-then" statement in which the antecedent is false, contrary to fact. That is, we can say

> If the temperature of the air remains constant for T time at F temperature, then the temperature of the liquid will equal F at t_n.

Under the present assumption we know that the antecedent is false and therefore, we know that at t_n the temperature will not equal F. In this case we have merely stated the law in a different manner and added the fact that the antecedent is false. In many contexts these statements are useful and they may be valid. However, it is clear that they are not concerned with an actual state-of-being in either the past, present, or future. They are hypothetical statements which may have a high degree of probability

and perform a valuable function but they are not measurements.

These points are rather obvious and we need not belabor them further. The reason for the discussion is that there are income theorists in all four schools that are future oriented. The Fisher Tradition has its very basis in predictions. Its income is a report of a change in predictions; its wealth a report of discounted predictions. Clearly the Fisher Tradition is not a measurement of wealth unless one defines wealth as a state of mind.

Accountants are critical of the Fisher Tradition for the reason that it is a prediction. They are fond of pointing out that they are concerned with what is, not with what will be. In view of the uncertainty of predictions we are inclined to agree with them.[8]

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[8]The view of the future taken here is in agreement with Russell which follows from Hume's Scepticism. Russell puts the case most strongly in Problems in Philosophy and later amplified in Human Knowledge. In the former he writes:

> The mere fact that something has happened a certain number of times causes animals and men to expect that it will happen again. Thus our instincts certainly cause us to believe that the sun will rise tomorrow, but we may be in no better position than the chicken which unexpectedly had its neck wrung. We have therefore to distinguish the fact that past uniformities cause expectations as to the future, from the question whether there is any reasonable ground for giving weight to such expectations after the question of their validity has been raised.

Bertrand Russell, "On Induction" reprinted in Arthur Pap., A Modern Introduction to Philosophy (New York: Free Press of Glencoe, 1962), p. 127.

If there is a choice between measurement and prediction we would eschew prediction. However, the accountant often justifies the past (entry) transco on the basis of assuming a "going concern," i.e., assuming that the firm will continue indefinitely in the future. Thus, the accountant avoids the problems of predicting the future by embracing an assumption about the future. This may be likened to a physicist who, knowing the impossibility of predicting the air temperature, decides to assume an air temperature. If that assumption is essential to his measurement, it raises some serious doubts about the resulting figures. The accountant uses a past transco and the relationship between that past (known) state-of-being and an assumed future state-of-being is not clear. Exactly what compels him to justify the past with an assumed future is an enigma. If he is assuming a future in order to justify using a past measurement as a present measurement, the situation is even more confusing. What does the unknown future have to do with a past state-of-being's relationship to a present state-of-being? Edwards and Bell allege that this assumption is, in reality, "the stationary state." But whether the state has or has not been stationary is an empirical question. If it has not been stationary, the accountants "measurement" turns out to be a counter-factual conditional. Whether or not it will be stationary in the future is another problem.

Boulding is also concerned with the future but in a more subtle way. It appears that he arrives at a particular constant

by "knowing" a complete pattern of transcos and then treating each instant in the pattern as if it were the present. Perhaps this is also a counterfactual conditional. "If we knew the future pattern, this constant would be appropriate."

Some theorists who argue for present market also feel it necessary to make some sort of assumption about the future. Edwards and Bell, for example, argue for a present replacement cost (equal to present market in our model) and point out that they agree with the going concern assumption.[9] Moonitz, whose most recent study indicates that present market is acceptable, states:

> To make these [value] allocations properly, predictions as to the outcome of the available alternatives are essential.[10]

In another study he states that "The problem of measuring (pricing, valuing) an asset is the problem of measuring future services..." He suggests three different methods of valuation which include "A current exchange price" and then concludes:

> The proper pricing (valuation) of assets and the allocation of profit to accounting periods are dependent in large part upon estimates of the existence of future benefits, regardless of the bases used to price the assets. The

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[9]Edgar O. Edwards and Philip W. Bell, The Theory and Measurement of Business Income (Los Angeles: University of California Press, 1961), pp. 6-7, footnote 4.

[10]Maurice Moonitz, The Basic Postulates of Accounting, Accounting Research Study No. 1 (New York: American Institute of Certified Public Accountants, 1961), p. 56.

> need for estimates is unavoidable and cannot be eliminated by the adoption of any formula as to pricing.[11]

Exactly why one feels that he needs to predict (estimate) the future in order to measure a present state-of-being is not clear. We agree that "valuation" as we define it below is intimately tied to the future but measurement is a different matter. If one decides to use a present or a past market price as a method of measuring the assets, the problem is to determine the present or past market price, not to estimate the future.

In summary, all four schools are deeply concerned about futurity and yet all claim to "measure income." We do not deny that predictions or reports of the predictions of others are valuable, relevant, veritable, etc. On the contrary, under certain conditions a prediction may be much more useful than a measurement. However, it is important to point out that these predictions are not, in fact, measurements. The phrase "measurement of income" is bandied about quite freely in the literature. In the interest of clarity of exposition the term measurement should not be used to describe a non-measurement.

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[11] Robert T. Sprous and Maurice Moonitz, A Tentative Set of Broad Accounting Principles for Business Enterprises, Accounting Research Study No. 3 (New York: American Institute of Certified Public Accountants, 1962), p. 56.

Intensive Versus Extensive Dimensions

The axiom of additivity is applicable to all the "fundamental" dimensions of physics. The notion is familiar to almost everyone and it probably is the basis for the ordinary (non-scientific) linguistic usage of the term "measurement." Despite its familiarity the concept is rather elusive when an attempt is made to state it precisely. Examples are abundant but a concise generalization which delineates the concept is difficult to come by.

A most elementary definition might take the following form:

> There is an operation of dimensional addition which corresponds to the operation of arithmetical addition.

There are two distinct operations in this definition. One, the operation of arithmetical addition which is the familiar notion of combining numerals according to the rules of arithmetic. Two, the operation of dimensional addition which is the combination of objects. If the sum of the numbers that are discovered by the operation of measurement on the separate objects is equal to the number that is discovered by performing an operation of measurement on the combined objects, the dimension is said to be additive.

For example, two separate rods, A and B, can be measured and discovered to be "2" and "3" feet respectively. By joining these rods end to end and measuring the combination we

will discover that it is "5" feet in length. The relation can be symbolized as follows:

$$A \longrightarrow a$$

$$B \longrightarrow b$$

$$(A \cup B) \longrightarrow (a + b)$$

Where "$\longrightarrow$" is defined as the operation of measurement, small case letters are the numbers discovered by the operation, "$\cup$" is the combination of the objects and "+" is the normal operation of arithmetical addition.

There are many dimensions which are subject to this axiom and there are many which are not. Length, weight, volume, etc., may be added. Hardness, density, sweetness, utility are examples of useful concepts which are not additive. We are not claiming that only those dimensions which are additive are measurable, as the narrow view holds, but we do assert that the additive property makes the measurement more useful, more informative, in a wider range of problem-situations by a greater variety of receivers. All writers would agree with this assertion. Stevens' various measurement scales are ranked according to a "crudeness" index and the least crude are those scales that are additive. He would be the first to agree that it would be preferable if all dimensions were additive.

The paradigm of additive dimensions, length, provides adequate illustration. Length units can be added, subtracted,

multiplied, divided, squared, roots extracted, etc., all of which conform exactly to the arithmetical operations of the same name. Temperature does not have this property. If one adds the numbers representing temperature, the sum is different from the temperature of the combined objects. There are of course laws of temperature that are stated mathematically but these are not generalized laws of mathematics.[12]

Bergman states the advantages as follows:

> The essence of measurement is that some arithmetical relations among the numbers assigned correspond, by virtue of a shared logical structure, to descriptive relations among the things to which they are assigned. The measurement we prefer to others is so constructed that a maximum number of arithmetical relations has such descriptive correlates or, as one also says, empirical meaning.[13]

We agree. The greater the arithmetical operations which have descriptive correlates of any given dimension, the greater the informational content of the measurement. Thus, in light of Criterion I an additive dimension is preferable to a non-additive dimension. We will be cognizant of this preference when we

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[12]One could quarrel with this view by speculating that the origin of numbers came from observations of length. Numbers are "squared," for example. This may be true but is not germane. The body of mathematics extant is a powerful tool regardless of its origin. Thus any dimension that behaves like a number has a tremendous advantage over those that do not.

[13]Gustav Bergmann, "The Logic of Measurement," State University of Iowa Studies in Engineering (1956), p. 28.

describe the dimension in a subsequent chapter.

The above discussion is only a rough sketch of the additive axiom. A considerable amount of work has been expended in an effort to develop a formal definition since Campbell's original distinction.[14] The following is an abstraction of the formalized distinction between an intensive and an extensive dimension.[15]

A dimension is said to be extensive if the following conditions are satisfied.

(a) The Objects x, y, z, etc., of the dimension are the domain of two relations, greater than and equal to, of which the following are true:

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[14]The most explicit presentations of this distinction can be found in Morris R. Cohen and Ernest Nagel, An Introduction to Logic and Scientific Method (New York: Harcourt, Brace & Co., 1934), pp. 293-297 and Gustav Bergmann and K. Spence, "The Logic of Psychophysical Measurement," reprinted in Feigle and Brodbeck, Readings in the Philosophy of Science (New York: Appleton-Century, Crofts, 1953), pp. 106-107. It is clearly implied in the presentations of Ernest Nagel, "On the Logic of Measurement," Ph.D. Dissertation, Columbia University (1930), pp. 18-24 and Arthur Pap, An Introduction to the Philosophy of Science (New York: Free Press of Glencoe, 1962), pp. 127-131. Campbell is making the same distinction when he distinguishes "a-magnitudes" and "b-magnitudes." Norman R. Campbell, An Account of the Principles of Measurement and Calculation (London: Longmans, 1928).

[15]Various lists of axioms of measurement have been presented. See, for example, Ernest Nagel, "On the Logic of Measurement," p. 18; J. P. Guilford, Psychometric Methods (New York: McGraw-Hill Book Co., Inc., 1954), p. 11; Patrick Suppes, "A Set of Independent Axioms for Extensive Quantities," Portugaliae Mathematics, X, Fasc. 4 (1951), p. 165. (The list here is adapted from Nagel and Guilford.)

(1) if $(x \succeq y)$ and $(y \succ z)$ then $(x \succ z)$, (transitivity)

(2) if $(x \succ y)$ then not $(y \succ x)$, (asymmetricality)

(3) if $(x = y)$ and $(y = z)$ then $(x = z)$, (transitivity)

(4) if $(x = y)$ then $(y = x)$, (symmetricality)

(b) There is a physical operation of addition, $+$, which can be performed on objects in the dimension, of which the following are true:

(5) if $(x = z)$ then $(x + y) \succ z$, (summativity)

(6) $(x + y) = (y + x)$, (commutativity)

(7) $[x + (y + z)] = [(x + y) + z]$ (distributivity)

(8) If $(x = u)$ and $(y = v)$ then $(x + y) = (u + v)$ (summativity of equals)

A dimension is said to be <u>intensive</u> if it satisfies condition (a) but not condition (b). All this may be stated more briefly as follows. A dimension is extensive only if (a) its objects are the domain of a transitive, asymmetrical relation, and (b) there is a physical operation to be performed on objects in the dimensions which is summative, commutative, distributive, and summative for equals. A dimension is intensive if it satisfies condition (a) but not condition (b). In terms of our previous discussion "extensive" is synonymous with "additive" and "intensive" is roughly parallel to "ordinal."

The additive axiom is germane to this study because there are <u>two</u> commodities in our model. The heterogeneity of the commodities bring up the comparability problem. The objects either

need to be in the same form or there must be a dimension that is common to both. We have described above several different kinds of comparisons and each of them have different requirements with respect to the dimension.

If an inter-temporal comparison is desired there are two alternatives:

1. The commodities must be in the same form at both instants, they must be inter-temporally homogeneous, or
2. There must be a dimension common to both commodities that is at least intensive and preferably extensive.

If the commodities are inter-temporally homogeneous we can discover the number of dollars or the number of bushels at both instants and then determine whether the numerosity at one instant is greater than, equal to, or less than it was at a previous instant. The requirement that they be in the same form, however, may abrogate the original purpose of the measurement--to provide information at a given point in time--and therefore we reject alternative (1).

Given the condition of inter-temporal heterogeneity, both commodities must be expressed in a dimension which is intensive. A quantity of money must be related to a quantity of wheat in such a fashion that we can determine an ordinal relationship in the

dimension. Temperature provides an example. Certain gases may be transformed into liquids and the temperature of each discovered. We can then ordinally relate the temperature of the heterogeneous objects. The comparison of wheat that has been transformed to money presents the same problem. The dimension then, must be intensive for inter-temporally heterogeneous commodities. Given the informational attributes of extensivity, it would be preferable if it were extensive.

If both commodities are held at either instant, if the commodities are instantaneously heterogeneous, and an inter-temporal comparison is desired there are two alternatives:

1. The objects must be combinative in some form that will permit an operation of measurement in a dimension that is intensive, or
2. The dimension must be extensive.

The first alternative is the problem of valuing the firm as opposed to the second alternative of valuing the commodities and summing them.

The existence of the first alternative raises some fundamental questions about income measurement which have received little attention by past investigators. It has been observed that sometimes "the value of the firm" is different from "the sum of the values of the commodities of that firm." Unfortunately the word "value" in the above phrases is left ill-defined and often it

changes meaning from the first phrase to the second. If the observation is true, with the meaning of "value" constant, it means that either (1) the dimension of "value" is not additive, or, (2) there is an interaction when the commodities are combined, or, (3) there is a commodity that is not included in the sum (entrepreneurship, perhaps). The possibility of there being a Gestaldt relationship of the firm to its commodities has received some preliminary investigation from the author and will be the subject of a forthcoming addendum to this study. We will not digress here to examine the issue but will leave the two alternatives open.

Instantaneous comparisons have the same alternatives. The combination of commodities must be measurable in an intensive dimension or the dimension must be extensive.

If an increment-comparison is desired the dimension must be extensive. Moh's scale provides an example. Suppose that there were two objects, A and B, which changed in hardness over time. By the scratch test we could place object A at number "1" on Moh's scale at t_1 and object B at "3" at the same time. At t_2 the numbers "3" and "5" were discovered for A and B respectively. Although both have changed by the same number of units, this does not permit us to say that they have changed equally. In the dimension of hardness the "degrees" of hardness between "1" and "3" may be greater than, equal to, or less than the degrees between "3" and "5". That is, the relationship between "2" and

"2" is indeterminate in an intensive dimension. Only extensive dimensions permit increment comparisons. A weight increment of one object is comparable to the weight increment of another object. In the case of weight, "2" is known to be equal to "2".

All four schools of income measurement ordinarily take the approach of valuing the commodities and then summing them. By this they must be implicitly claiming that the dimension is extensive. This means that all the comparisons can be made.

1. Instantaneous comparison of Firm A to Firm B at both t_1 and t_2.
2. Inter-temporal comparison of both firms from t_1 to t_2.
3. Increment-comparison of Firm A to Firm B.

Moreover it means that the arithmetic operations of "+" and "-" on the numerosity of units have "descriptive correlates"; they are meaningful in discriminating the dimension. In more familiar language it means that the wealth of Firm A minus the wealth of Firm B yields a number that is meaningful in the same way that "this rod is longer than that rod by 2 inches." Likewise, it means that the "income" of the firm has empirical meaning in the same fashion as "this tree has grown 5 feet."

If the dimension is not extensive but the units are added, it is difficult to conceive exactly what the resultant figure means. Suppose that we sum the figures "2" and "3" on Mohs' scale.

The figure "5" is easy to come by but its empirical meaning is nil.

For this study we will follow the general practice of valuing the commodities and summing them. We will utilize the arithmetical operation of "+" by measuring each commodity separately and then comparing the total to another total. We noted above that we were required to describe a dimension prior to a measurement. In view of the summation approach we must modify that requirement to an extensive dimension.

In light of the enormous increase in information that it provides there is good reason to have a strong preference for an extensive dimension; in light of the fact that all four schools utilize summation and the fact that we will follow the same methodology, the property of extensitivity in a dimension is an absolute requirement.

Objective Versus Subjective Measurements

Any comprehensive review of "objectivity" would entail arguments of an epistemological and metaphysical nature that are much beyond the scope of this study. The author attempted to avoid the whole subject but the literature, particularly the accounting literature, has a plethora of statements about objectivity. Unfortunately most of the statements are in the form of criteria without any further explanation.

Almost all accounting texts have some phrase about

"objective and verifiable evidence." Generally this is given in support of the "cost principle." For example a "modern" text states

> There are several reasons for accountants' choice of original costs as the basis of value. The first is objectivity. The cost of most assets is contracted and can be verified through business forms. No subjective estimates are required, as would be necessary in the case of direct valuation.[16]

The clear implication is that the existence of business forms on contractual obligation make a measurement "objective." Thus, one gets the impression that anyone who can read will come out with an objective valuation.

Another example is in a "comprehensive volume" that is usually used in a course entitled, "accounting theory" or "principles of accounting." The following rather lengthy quote is presented because it is the entire discussion in a book of 980 pages.

> Accounting seeks to present its findings on a foundation of facts determined objectively and subject to verification. Cash receipts and disbursements can be adequately supported by vouchers, and cash on hand is determined by count; full support and verification for this element and its changes are available. Findings here can be fully objective. Purchases of goods and services as well as sales are also generally well supported by evidence and subject to verification. There are a number of areas in accounting, however, where determinations

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[16]Donald A. Corbin, Accounting and Economic Decisions (New York: Dodd, Mead & Company, Inc., 1964), p. 230.

> must be based in part upon judgment, estimate, and other subjective factors. The recognition of depreciation is an example of the latter. But the degree of estimate can be minimized by the attempt to develop evidence that will lend objective support to conclusions. Objective determinations are encouraged as means of closing the doors to possible error, bias, or even intentionable fraud, and achieving an accounting that can be accepted with confidence.[17]

Karrenbrock feels that cash outlays are completely objective, and perhaps they are, but he avoids the difficult question of whether those outlays should be capitalized or expensed. That is, the question of how the outlay affects the income of the firm. Two accountants could readily agree on the amount of an outlay but disagree on the effects of that outlay on income. We can all agree that we should avoid fraud, error, etc., but how does the criterion of objectivity serve this laudable end?

Paton and Littleton present the following definition

> "Objective evidence" therefore is evidence which is impersonal and external to the person most concerned.[18]

Obviously the referent of "the person concerned" is to management and the purpose is to prevent fraud. The CPA is "independent" and, therefore, all measurements would be impersonal and

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[17]Harry Simons and Wilbert Karrenbrock, Intermediate Accounting (Cincinnati: Southwestern Publishing Co., 1964), p. 48

[18]W. A. Paton and A. C. Littleton, An Introduction to Corporate Accounting Standards (Ann Arbor, Michigan: Edwards Brothers, Inc., 1940), p. 19.

external if he is the metrician. If the sole criterion of objectivity is "impersonal and external" then any person who has no vested interests in the particular measurement would be "objective." Clearly, this is an impoverished criterion of objectivity.

People who are relatively unfamiliar with accounting usually assume that costs are, ipso facto, objective. Alexander, an economist, writes:

> The accountant in his turn has tried to eliminate the element of subjective judgment from the determination of income. He has tried to estimate as nearly as possible hard and fast rules of calculation in order to eliminate the guesswork and to ensure precise measurements.[19]

This pattern of thinking among economists is quite common. Most think that costs are readily determined and thus the accountant is objective. Mr. Alexander thinks that avoidance of the "subjective" also ensures precision. He mentions the accountants' precision in several other connections.

> ...the accountant has chosen a concept of income which permits precise measurements but which yields misleading results under conditions of fluctuation and uncertainty.[20]

The more thoughtful accounting writers have not taken such

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[19]Sidney S. Alexander, "Income Measurement in a Dynamic Economy," revised by David Solomons, in W. T. Baxter and S. Davidson, eds., Studies in Accounting Theory (Homewood, Illinois: Richard D. Irwin, Inc., 1962), p. 132.

[20]Ibid., p. 134.

a sanguine view. Paton marvels at the faith in the reliability and objectivity in cost figures. He writes

> It is sometimes assumed that the cost of goods on hand is a definite, recorded fact, completely objective and dependable. As indicated by the discussion of the inventory process in the preceding chapter this assumption is entirely unwarranted, in all but a few special situations. The fact is that the actual cost of the inventory is generally not readily ascertainable. Determining cost is a difficult task, fraught with technical difficulties and requiring the use of judgment all along the line. At the worst the reported cost is little more than an arbitrary guess; at the best it is a careful estimate, made by people familiar with the circumstances. The 'at-cost' inventory figures in the position statement may be very precise, but it often covers a multitude of sins. Accountants are supposed to be thoroughly familiar with this situation and hence the faith that some of them seem to have in the objectivity and reliability of compiled cost data is something at which to marvel.[21]

Paton is talking about the faith that accountants have in cost data. If accountants, who are familiar with the problem, have such faith, one can hardly criticize some one who is not familiar with the problem for having a similar belief. The fact of the matter is that costs are neither "objective" nor "precise" as Mr. Paton indicates.

The metrics literature also makes wide use of the distinction between "objective" and "subjective" dimensions. The

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[21]William A. Paton, Asset Accounting (New York: The Macmillan Co., 1952), p. 54.

discussion is diffused but the alignment generally follows the distinction between the broad and narrow views. As might be expected, since the opposing camps are psychologists and physicists, the quarrel often takes the form of psychological versus physical dimensions. This dimension distinction has wide use and an intuitively compelling character but unfortunately it is highly confused.

One indication of the confusion emerges in the fact that the dimension distinction is held in at least two different forms. At times the "psychological" dimensions of brightness, hue, loudness, pitch, etc., are distinguished from the "physical" dimensions of length, weight, hardness, temperature, etc. That the distinction is held in this form is evidenced by the familiar practice of discussing length, width, hardness, etc., under the heading of "physical measurement" or "measurement in Physics"; and brightness, hue, loudness, etc., under the heading of "psychological measurement." In a typical pattern of organization, the principles of physical measurement are stated, and it is pointed out that length and weight are capable of "fundamental measurement," whereas hardness, density and temperature are capable only of "derivative measurement." Having laid this groundwork, the writer then turns to a discussion of "psychological measurement," addressing the question of whether brightness, hue and other such dimensions are measurable. This pattern is typically followed by those writers whom we have classified as

holding the "narrow view."[22]

In a second form, every psychological dimension is thought to have its physical counterpart and every physical dimension its psychological counterpart. Thus, "psychological" length, weight, etc., are distinguishable from "physical" length, weight, hardness, etc. Illustrations of the employment of this form of the distinction are normally from the broader school.[23]

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[22]Campbell, "Measurement and Its Importance for Philosophy," pp. 121-142 and Gustav Bergmann and K. Spence, "The Logic of Psychophysical Measurement," provide excellent examples of this pattern.

[23]The following is quite typical: "Many discriminable characteristics (psychological magnitudes) have known physical correlates. For example, the chief physical correlate of the discriminable characteristics of weight is the 'physical weight' of the object. The measurement of 'physical weight,' in fact, the measurement of all physical correlates, is a problem for the physicist, but the measurement of the so-called subjective magnitudes is a problem for the psychologist." T. W. Reese, "The Application of the Theory of Physical Measurement to the Measurement of Psychological Magnitudes," Psychological Monographs, Vol. LV (1943), p. 1. Another example is found in S. S. Stevens and E. H. Galanter, "Ratio Scales and Category Scales for a Dozen Perceptual Continua," Journal of Experimental Psychology, Vol. 54 (1957), pp. 377-411. The authors examine the relation between "classes of scaling procedure" for "subjective" or "apparent magnitudes" (p. 377a). A dozen "perceptual continua" are studied, among them "subjective (apparent) length," "subjective (apparent) weight," etc. In the process, the functional relations between subjective magnitudes and physical magnitudes are examined. There is said to be a need "to know how subjective weight increases with physical weight" (p. 386b). Physical length and weight are referred to as "stimuli" or "judgments of apparent length and weight." Obviously the main difference between subjective and physical characteristics in this study is whether an instrument is used to make a judgment about weight, length, etc.

Many authors attempt to set up a definition that would guide us in distinguishing between psychological (subjective) and physical (objective?) dimensions. One of the most straightforward definitions is presented by Stevens and Volkman. They write:

> Pitch is one of the psychological aspects, or attributes, of tone. It is one of the dimensions in terms of which we are able to distinguish and classify auditory sensations. Pitch differs from frequency in that pitch is determined by the direct response of a human listener to a sound stimulus, whereas frequency is measured with the help of instruments.[24]

Two criteria may be elicited from this passage. One, psychological dimensions are dimensions of sensations; physical dimensions are dimensions of physical entities (objects, events, processes).[25] Two, psychological dimensions are determined by means of sense-perception; physical dimensions by means of instruments.

Criterion one is irrelevant to this essay and we can pass over it. We stated above that we were here dealing with a firm and such a firm, by definition, has no sensations. Thus, sensation

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[24]S. S. Stevens and J. Volkmann, "The Relation of Pitch to Frequency: A Revised Scale," American Journal of Psychology, Vol. 53 (1940), p. 329.

[25]Many other dimensions along with pitch are regarded as purely psychological. For example, brightness and hue are presented in the literature in many instances as a psychological dimension. "It is only in recent years that a fairly clear concept has been gained of the various factors involved in the transition of radiant energy to the mental quality 'color'." R. M. Evans, An Introduction to Color (New York: John Wiley & Sons, Inc., 1948), p. 1.

measurements if they be the correct distinction between subjective and objective measurements are irrelevant to the discussion at hand.

Criterion two is relevant to our discussion. Note that this criterion seems to assume that verification by sense perception and verification by instruments are opposite, mutually exclusive methods. One reason for thinking this lies in the not uncommon tendency to regard verification by unaided sense-perception as "subjective," in contrast with verification by instruments. If this is the distinction between subjective and objective we are in difficulty. Nevertheless, we have often heard the claim that the use of instruments makes the "subjective," the "imprecise," the "inexact," and the "vague" objective, precise, exact and clear.[26] Now

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[26]Reese apparently employs this criterion in the following passage: "There does seem to be one difference between the procedures adopted by the physicist and that adopted by the psychologist. Having identified a characteristic, the physicist in the interest of consistency and greater discriminatory power, usually abandons it for another characteristic which is correllated with the first one. For example, the characteristic of subjective weight may be identified by a series of operations which involve, among others the operation of hefting. The physicist will find that he is able to construct a magnitude that correlates with the original subjective magnitude but which substitutes operations involving balances for the operation of hefting. Furthermore, the discriminable characteristic is changed from subjective weight to some special characteristic such as the position of a pointer....By this means the physicist is able to extend the scale beyond those limits imposed by the low discriminatory capacity of the observer with respect to the original discriminable characteristic." T. W. Reese, The Application of the Theory of Physical Measurement to the Measurement of Psychological Magnitudes, Psychological Monographs, Vol. LV (1943), pp. 1-2.

in some sense of these terms, and to some degree, this claim is probably correct. But it is difficult to see how it could be made, as it often is, with such assurance--almost a priori assurance--except on the hypothesis that its proponent is for the moment overlooking the fact that someone must read the instrument. He must be overlooking the fact that the perception of pointers, dials, color changes (as in litmus paper) and other such indicators is subject to most, if not all, of the errors of perception which psychologists have impressed on us for centuries. There may be advantages to the use of instruments in procedures of verification, but they are not those of a method which does not involve sense-perception over one which does.

As Reese has noted the discriminable characteristic is usually conceived without the aid of an instrument and the instrument is later invented in order to make the discriminable characteristic more exact. That the instrument is a powerful tool as a sense aid is not here disputed. However, the thing that is in dispute is whether an instrument or the lack thereof makes one measurement more or less objective than another measurement. One can state, and one often does, that X is heavier than Y or that x is longer than y without using an instrument. Can one charge that the above statements are about psychological dimensions or that they are subjective, and that, in order to make them statements about physical dimensions or to make them objective, they

would have to be verified by means of an instrument? To say that a dimension changes because of the operation performed on the dimension is an odd method of viewing dimensions. Would the dimension change if we used different instruments to measure, say, the weight of an object? We can state that "X is heavier than Y" and verify it by (a) using a simple fulcrum balance, (b) using a spring balance, (c) using a chain balance. Must we say that for each of these procedures the statement in question is about a different dimension?[27]

In addition we should note that at least some observational statements about at least some of the so-called psychological dimensions are, or can be, verified by instruments. Observation statements about the relative pitch of very soft sounds (perhaps inaudible sounds) can be verified by means of a microphone amplifier earphone device. Observation statements about the hues of distant objects are verified by means of telescopes. Two instruments frequently employed in experimental work on color are the flicker photometer and the colorometer. By the use of these instruments, much greater precision is possible than by means of

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[27]Obviously the question posed is intended to be rhetorical. However, it is only fair to warn the reader that some writers would give an affirmative answer. For example,

> "In principle the operations by which length is measured should be uniquely specified. If we have more than one set of operations we have more than one concept, and strictly there

the naked eye. Does the fact that we have been able to devise instruments to get more exact or precise measurements change the character of the dimension that we are measuring from a psychological-subjective to a physical-objective measurement?

Some writers seem to believe that a relative magnitude cannot be determined in a procedure of measurement by "direct" perceptual comparison of the objects within the dimension. Consider the following:

1. We determine whether x is heavier than y
   a. by lifting the objects
   b. by placing them on opposite arms of a balance
2. We determine whether x is longer than y
   a. by simply looking at and comparing them
   b. by aligning them
3. We determine whether x is harder than y
   a. by feeling them
   b. by attempting to scratch them with one another
4. We determine whether x is warmer than y
   a. by feeling the objects
   b. by bringing them into contact with a mercury thermometer

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should be a separate name to correspond to each different set of operations. (P. W. Bridgeman, "The Logic of Modern Physics" reprinted in Feigle and Brodbeck, Readings in the Philosophy of Science, p. 386.)

There are some writers who apparently believe that determinations of equality and inequality in a procedure of measurement must be of the b-type. One gets this impression from those writers who assert that greater than and equal must be "operationally defined." Presumably the "a" determinations would not be regarded as "operations" by these authors. Whether this is a correct interpretation or not, it is important to reveal the error in the view that determinations of equality and inequality in a procedure of measurement must be of the b-type.

The distinction between the a- and the b-type determinations of magnitude is that we use the words "feels like," "looks like," etc., in all of the a-types and do not in the b-types. In all of the a-types above greater than or less than is defined in terms of how objects appear to some particular sense, whereas the b definitions are of a different type. "X looks longer than y," "x feels heavier than y," etc., are what some philosophers have called reports of "immediate" or "direct" perception.

The clear implication of the literature is to regard all a-type measurements as "subjective" and all b-type measurements as "objective." In saying that x feels heavier than y, we sometimes express uncertainty as to whether x is heavier than y. Now if we feel uncertain as to whether x is heavier than y then we ought not to conclude that x is heavier than y. Such a conclusion would indeed seem to be "subjective." However, in a different

and quite acceptable sense, the word "feels" does not express the speaker's uncertainty. A man can say of a rough surface that it feels rough in order to contrast the way it feels with the way it looks. In saying this he does not necessarily imply that he is uncertain as to whether the surface is rough. In the second sense of "feels" there is not in general any "subjectivity" in concluding that x is heavier than y from the fact that x feels heavier than y.

But surely, someone may object, 1a is a subjective determination in the sense that only the person making the determination can judge whether one object feels heavier to him than another. In determination 1b, on the other hand, one tries to discover which object overbalances the other and a judgment on this matter is one which any normal person can make. Therefore, 1a involved a subjective, 1b an objective, judgment. This view is mistaken. There are two types of errors that could be involved in the a-determination. One, errors of use; two, errors of perception.

In the first--error of use--we mean that if someone were to describe with unaided sense perception an object as being both circular and square, we would say that he had made an error of use. Someone could then criticize this unaided sense perception as being self-contradictory, and this is what we mean by an error of use. If, however, someone describes an object in a non-contradictory fashion, but it is in disagreement with another person's perception then we can be certain that there has been an error in

perception. If a person lifts x and says it feels heavier than y, and we have no reason to doubt his intent, there is no good reason to reject the judgment on grounds of subjectivity. If we doubt the person's ability to perceive, we have good grounds for rejecting the judgment or at least grounds for making further investigation before we accept it. The criterion however is our judgment about the person's ability to perceive, not subjectivity versus objectivity.

Since we know that errors are made in perception, we need to exercise great caution before we accept or reject perception reports. We need to make comparisons of our perceptions to those of other persons, to compare our present perception with the memory of past perception and compare our unaided perception to our perception of a pointer on an instrument. However, the instrument is not the final arbiter. If the butcher's scale reads "10 pounds" when he places one weiner on it, all of us would reject the measurement. We would accept our own "subjective" sense of hefting and complain that the instrument was wrong. Likewise, if the butcher told us that one weiner weighed "10 pounds" on his scale we would accept our "subjective" judgment and doubt his perception if not his honesty.

In the above examples we have accepted our own judgments, "subjective" though they may be, and rejected the "objective" determinations of others. The problem is more complex, however, than the exclusive reliance on our own perception. If

we perceive an object as "gray" when everyone else perceives it as "red" we normally accept the majority's perception. The statement "I am color blind" means (1) my perception is different from others, and more importantly (2) I accept others' perception as true and reject my own. The principle is clear: Observer agreement is both the ordinary and the scientific criterion for errors of perception. We make a "democratic assumption" and the majority's perception prevails.

In general, the advantage of using instruments is that it increases observer agreement. The purpose of instruments is to make the perception easier, not to avoid perception. If the instrument reduces the discriminable characteristic to a pointer reading, the measurement is easy and there is a high degree of inter-observer agreement. This is an important advantage but it has nothing to do with a dichotomized view of reality as being either "physical or psychological," "internal or external to the mind," "objective or subjective."

Observer agreement is peculiarly amenable to empirical determination. Given the "democratic assumption," errors of perception are subject to empirical determination. This is a question of fact. Either one perceives correctly (agrees with the majority) or he does not. Often, in the perception of numbers, there is no clear majority of any single number. In such cases the usual scientific procedure is to change the "democratic

assumption" from a mode to a mean. Several readings are taken and the mean is defined (assumed) to be the true measure. This has troubled some "absolutists" and admittedly there are epistimological difficulties. However, in the opinion of the author, the difficulties of using a mean are in essence the same as those of using a mode. The basic question is how do we know what is correct or true. The usual answer is observer agreement and the fact that the agreement is expressed as a mean is little different from its expression as a mode.

The reliance on inter-observer agreement of "what is" and "what is not" brings us full circle. The notion of "what is" as a simple "look and see" procedure has been subject to a series of experiments that reveal some striking results. The Gestalt psychologists have gone a long way toward proving that the "construct" is basic to perception. A classic experiment in visual perception required the subjects to wear eye-glasses that reinverted the retinal image. This caused the world to look upside down. The subjects went through three distinct phases:

1. Disorientation and severe personal crisis
2. Confusion
3. Assimilation

In terms of our earlier discussion they changed "constructs," they assimilated a new method of perceiving the world and then everything looked normal. Inter-observer agreement among the

subjects after assimilation was almost perfect. They would, of course, disagree with all other observers who did not have the same mental construct that was occasioned by the glasses.[28]

Another example of perception according to a previous construct is provided by Brunner and Postman. They exposed a deck of playing cards to a group of subjects and asked them to identify each card. Most of the cards were normal but some were not; for example, a red three of spades and a black seven of hearts. The subjects went through an experience similar to those subjects mentioned above. First, on short exposure they nearly always identified the cards, both the normal and the abnormal, with little hesitation and usually correctly, i.e., the normal as they were and the red three of spades as either the three of spades or the three of diamonds. On a longer exposure they became confused and anxious and could only say that there was "something wrong." Most, after prolonged exposure, adjusted to the new deck and had no trouble. They identified the anamolous cards correctly, i.e., as a "red three of spades." Their first perceptions were in accordance with the construct of a normal deck of cards. The identifications were made within that construct. After the assimilation of the new construct the identifications--perceptions--were in

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[28]See Harvey A. Carr, An Introduction to Space Perception (New York: 1935), pp. 18-57.

accord with it.[29]

There is now quite an accumulation of evidence in psychology that the construct is of primary importance in perception.[30] The old simplistic notions about "reality" are open to serious doubt. "Reality," in some sense which is not yet clear, is a product of a construct. Certainly there is interaction. The construct is also, in some sense, a product of reality but there is no one-to-one correspondence nor is there a unilateral chain of evidence. What is "objective," what is perceived to be evidence, is highly influenced by the previous construct.

Philosophers have also been struggling with this problem for many years. Epistemological theories have necessarily been concerned with "objective" and "subjective," often with surprising results. On several occasions the definitions of objective and subjective have been reversed. Some philosophers consider that what goes on in the mind is real, hence objective, and what we perceive is a reflection of that reality and thus subjective. This is the exact opposite of the present dictionary definitions. C. I. Lewis has been instrumental in developing an epistemological theory of interaction. He writes:

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[29]J. S. Brunner and Leo Postman, "On the Perception of Incongruity: A Paradigm," Journal of Personality, XVIII (1949), pp. 206-223.

[30]Also see Hastorf and Rodriques quoted in Thomas Kuhn, Structure of Scientific Revolutions, (Chicago, University of Chicago Press, 1962), p. 112.

> ...the distinction of real from unreal is a classification, and that which is designated as "unreal" as well as the "real" is given in experience. Knowledge a priori is knowledge of our own concepts.[31]

In another context where he is trying to describe how we have knowledge of objects he concludes by saying:

> The ascription of this objectivity to the presentation is the conceptual interpretation of what is presented.[32]

The point in philosophy is a little more muddled because of the internal quarrels and the difficulty of expressing concepts without utilizing a prior concept. However these very difficulties are an important datum to the object at hand. The existence of such difficulties should prevent the ejaculatory charge that something is "subjective" and therefore unacceptable. The burden of proof should be reversed: if subjective and objective are to be used in a prejudicial manner the user should be required to define the terms. At the very least this would prevent them being utilized as a propagandistic smoke-screen. Unfortunately the terms are all too often used that way in the present literature.

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[31]Clarence I. Lewis, Mind and the World-Order, (New York: Charles Scribner's Sons, 1929), p. 435, emphasis supplied.

[32]Ibid., p. 133.

CHAPTER V

THE THEORETICAL CONSTRUCT

In the preceding chapters we have constantly run up against the problem of determining the theoretical construct. We found that the criterion of relevance could not be applied in the absence of such a construct. In measurement theory, we found that the dimension must be 'conceived' prior to the measurement. Thus, if we are to apply the criteria developed above, we must explicitly consider the construct and the dimension. Such a consideration is the purpose of this chapter.

The Value Dimension

The word 'value' and its derivatives are unfortunate in this discussion because they bring up conjectures of "goodness," and the metaphysical debate rages. In the sense of "goodness," "value" is quite different from the concept of "measure." Dewey speaks of it as a radical split:

> When one looks at the problem of valuation in this context, one is at once struck by the fact that the sciences of astronomy, physics, chemistry, etc., do not contain expressions that by any stretch of the imagination can be regarded as standing for value-facts or conceptions. But, on the other hand, all deliberate, all planned

> human conduct, personal and collective, seems to be influenced, if not controlled, by estimates of value or worth of ends to be attained....This contrast between natural science and human affairs apparently results in a bifurcation, amounting to a radical split.[1]

An enterprise is obviously deliberate, planned human conduct and thus is influenced by the worth of ends to be obtained. That end, by assumption is "income."

It is clear that, if Dewey is taken literally, the present inquiry would be excluded from science and placed in the discipline of ethics or morals. The valuation coefficient finally selected would fall into a category of "values" which by definition[2] would not be amenable to scientific inquiry. The conclusions reached would be neither subject to validation or verification and thus "a matter of opinion."

In the analysis of the word "value," Dewey points out that it is used as a noun, an adjective and a verb. It may have several

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[1]John Dewey, Theory of Valuation, International Encyclopedia of Unified Science, I and II: Foundations of the Unity of Science, II, No. 4 (Chicago: University of Chicago Press, 1939), p. 2.

[2]By definition of the logical positivists. There are some who quarrel with the philosophy of logical positivism, particularly in the social sciences. For example, Geiger writes

> ...the dichotomy between ends and means, between morals and technology, is precisely what has been challenged by the very history of the scientific method itself.

(George R. Geiger, "Toward an Integrated Ethic," The Cleavage in our Culture, ed., Frederick Henry Burkhart (Boston: Beacon Press, 1952), p. 107.)

meanings when used as any of these parts of speech, but the double usage as a verb is particularly relevant to the subject at hand. He writes:

> ...the words "valuing" and "valuation" are verbally employed to designate both prizing, in the sense of holding precious...and appraising in the sense of putting a value upon, assigning value to.[3]

The activity that we are concerned with is obviously the verbal use of value. The trader prizes, holds dear, his cash and wheat contracts. He also prizes his life, sunsets, Michelangelo artifacs and many other things. He believes these things to be "good" or "beautiful" and therefore holds them precious, prizes them. This may be done with a vast array of things without comparisons; one may prize both a sunset and a Picasso without ever bothering to rank them in degree of preciousness.

The second use of the verb value--appraisal--does imply a comparison, however. By definition, it is "...primarily concerned with a relational property of objects...."[4] When one "appraises" something, he is ranking it in comparison to another object. This often results in an extremely difficult choice. Many of the interesting and unresolved problems of philosophy are concerned with such choices between two "goods," "beauties," "values."

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[3]Dewey, p. 5.

[4]Dewey, p. 5, emphasis supplied.

The distinction between value as positive, attribution of the good, and the assignation of a degree, order, rank to that goodness, is important to our study. There is considerable debate about the origins of value, i.e., whether good is "intrinsic" or "better than." Mitchell writes:

> Though good is the central value category it is not necessarily the most fundamental. The question of the logically "primitive" term is mainly one of system building. Thus Brogan defines good in terms of "better than" while Felix Cohen defines the latter in terms of the former.[5]

We shall not digress here to a discussion of which is more "primitive" or "fundamental." Instead, we will assert that this study is concerned with the latter, "appraisal," "better than," or "degrees of goodness" rather than the positive attribution of the good. We are thus assuming that commodities are good. We attribute goodness to commodities by assumption, and the relevant question is: how does one rank, order these "goods?" It is important to note that we are using "goods" in the philosophical sense--as an antonym for "bad." The commodities have a property or characteristic that makes them "goods." The fundamental question of the nature of this characteristic is avoided, so that we can concentrate on the relationship of "goods."

The question is not how to classify things as "good" or

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[5]E. T. Mitchell, "Values, Valuing, and Evaluation," Value: A Cooperative Inquiry, ed., Ray Lepley (New York: Columbia University Press, 1949), p. 191.

"bad." Instead, we will intuit a class of good things and then ask how to rank the things that belong to this class. Once the problem has been stated in this fashion, another fundamental question is raised: why should one rank goodness? That is to say, why would one make a decision about the rank of two goods when both are, by definition, "good" and hence desirable? It would obviously be more comfortable to avoid the appraisal and simply prize goodness.

The answer must be concerned with the existence or maintenance of the goods. If all goods are capable of simultaneous existence, any ranking process would be unnecessary. For example, suppose that there is an array of goods, X_1, X_2, X_3, ... X_n (sunsets, food, Bach, etc.). If one could obtain, maintain all of these goods at the same time, no ranking is necessary. Except as an intellectual exercise, there is no reason to say that "X_i is better than X_j." Such a statement is a curiosity. What does it mean to say that "X_i is good, X_j is good, both are capable of simultaneous enjoyment, but X_i is better than X_j?" If both are capable of existence at the same time, the "better than" statement is, at best, useless and, at worst, meaningless. However, if X_i obviates the existence of X_j, then a choice is enforced, and the ranking process is necessary.[6]

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[6]For a full development of this point, see: W. D. Lamont, The Value Judgment (New York: Philosophical Library, Inc., 1955), p. 20 ff.

To make the example specific, suppose that one could enjoy a good dinner with a beautiful view and with good background music. Since all three are capable of being simultaneously enjoyed, there is no reason (except as an intellectual exercise) to express a preference. In fact, the act of expressing a preference would very likely be distasteful. There are three goods, all desirable, and preference or choice implies the obviation of one of these goods. Sacrificing a good is a disagreeable act, and the mental process of choosing which one to sacrifice is also likely to be disagreeable.

If one posits the example in a different manner, the disagreeableness of choice is made clear. Suppose that the situation is one where restaurant A offers good food and good music but no view, and restaurant B offers good food and a beautiful view but no music. One is forced to choose between two goods. "Forced" is an apposite term because one would not choose if both goods were available. Only where external forces put one in the position of relinquishing one good in order to get another would the disagreeable act of ranking be undertaken.

Valuation, therefore, is intimately related to the concept of "sacrifice." The sacrifice is one prized good for another prized good. There would be no choice or sacrifice between a good and a bad. No choice is necessary then, because the classificatory procedure had already made the decision. The choice can only arise between two competing goods. In short, the appraisal (comparative, relational judgment) is the expression of a conscious choice

between two desired, competing goods, ends, values and is made--or is useful, meaningful--only when circumstances force the sacrifice of one for the other.

> VALUATION PROPOSITION I: Valuation, in this context, arises only when we are forced to sacrifice one good in order to obtain, maintain another good.

From this proposition, it is clear that a comparative judgment must be made. One must rank the alternatives in order to choose which good is to be sacrificed. An ordinal scale must be created. In terms of the previous example, the person must rank music and view. If he prefers music to view, then he will select restaurant A and sacrifice restaurant B. There are several corollaries to this choice.

The process is reversible. By the overt act of choosing restaurant A to restaurant B, we can infer, a priori, that the person prefers music to view. That is, if the ordering of the elements yield an ordering of the alternatives, then an ordering of the alternatives yields an ordering of the elements.

The final choice conceals a number of previous choices. There were a number of other choices that were eliminated in order to focus on the final alternatives. In the typical situation, a person is not confined to two alternatives; he also has the opportunity (C) to stay home, (D) to go to the theater, etc. Thus, when he focuses on choice A or B, he has already ranked them higher than C, D, etc. Then the final choice of A is more valuable than B; B more valuable than C, D, etc.

There is a vital temporal dimension to all valuation. Time is an inherent restraint on the ability to enjoy goods. The sacrifice of one good for another may be temporary because one can plan to enjoy both. In this case, the valuation process is temporal. One chooses the temporal order of goods and, if the plans work out, both goods will be enjoyed. Thus, one can plan to visit restaurant A today and restaurant B tomorrow. Note, however, that the sacrifice is still operating. Since both are "goods," it would be preferable to avoid any sacrifice, but this is impossible. B is sacrificed for A today, and A is sacrificed for B tomorrow.

At first blush, it is tempting to say that A is more valuable than B because A was chosen first. This statement is correct today, but it is clearly specious tomorrow. If, when tomorrow arrives, B is chosen and A is sacrificed, clearly B is more valuable at that moment. If not, A would be chosen again. The position of goods in the ordinal scale may change with the passage of time, and it is therefore imperative to state the time condition when valuations are made.

A further corollary of the time dimension is the impossibility of refusing to value. Any attempt to avoid a valuation will result in the status quo receiving the highest valuation. For example, if the person is at home and procrastinates in the choice between A and B, he is clearly choosing C (to stay at home--maintain the status quo). One available alternative is the maintenance of the status quo, and the so-called refusal to evaluate is an overt choice

of that alternative. In a most important sense, then, one is forced to evaluate alternatives at all points in time.

> VALUATION PROPOSITION II: Valuation is a continuous activity being performed at all instants in time.

This proposition has further conditions. When one is continually choosing among alternatives in a moving temporal dimension he is necessarily predicting the future. The choice is between competing states-of-being that lie in the future. The choice is not between things extant. One may have an existing good and decide to continue it, but this decision is about the non-existent future state of that good, not with its past existence. Thus, the sacrifice of B for A now is the result of a prediction about the state of A and B in the future.

The ex ante view of value causes some serious difficulties in measurement. As we pointed out above, the future can be predicted but not measured. Measurements are ex post.

For example, assume that a person decides to choose restaurant A over restaurant B. At the moment that this decision is made the chooser is anticipating the state-of-being of A and B and he makes his choice on the basis of this prediction. The sacrificed alternative B, is an anticipation and not subject to measurement. The chooser ranks A and B but the ranking is a prognostication of satisfactions. It is not a measurement of an existing state.

A physical analogy may be helpful. Suppose that a person were attempting to maximize length. His choice is between two

objects, A and B, which, at the present moment, are identical in all respects. Clearly if they are currently identical he will be indifferent. However, if both are expected to grow in the future, there is a basis for choice. If A is expected to grow at a faster rate than B, then A will be selected. Thus, the "value" of A to the chooser is greater than the value of B. However, the present length of both objects are equal. There are two different concepts here: (1) The present length which is measurable, and (2) The prediction of length which is not measurable.

This leaves us in a quandary since our objective is to select a valuation coefficient which measures the value of commodities. Note however that we can create an ordinal scale of value. Clearly, if A is chosen it has a higher value than B to the chooser. Thus if we can measure B in some acceptable unit we can then say that A has a greater number of those units. For example, suppose that A and B have five linear feet. A is selected because it is expected to grow at a faster rate. We can not say that A has more length than B but we can say that the chooser prizes A more than B. Since the chooser sacrifices B to obtain A we can measure B and say that A is more valuable than five feet of B. A is equal to B in length but A is greater than B in preciousness to the chooser. This preciousness is at the present moment and may change in the future but this does not negate the fact that A is more valuable than B at the present moment.

> VALUATION PROPOSITION III: The current choice, what the chooser presently holds is, prima facie, more valuable to him than all other alternatives.

This is an ordinal scale of value. In such a scale we cannot say anything about the magnitude of interval. This is a serious limitation to measurements because it does not permit mathematical manipulation. Moh's scale is quite similar to our value scale. We report that mineral X is harder than mineral Y, but we have no well-defined dimension of hardness that permits us the use of an intermediate unit for the comparison. The same is true of the value dimension. We can say that A is more valuable than B, but we cannot say that A has a definite value in the same way that an object has a definite length. This point has troubled economists for a great many years, and more recently the metricians have also been concerned.[7]

This difference between the ordinal and cardinal scales has to do with the state of our ignorance about the exchangeability within certain dimensions. Suppose that we could discover that there existed substance s that would allow us to vary the hardness of all minerals. If this were true, we could add substance s to mineral Y until it was equal in hardness to mineral X. Or, we could deduct

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[7]E.g., cf. Donald Davidson and Jacob Marschak, "Experimental Tests of a Stochastic Decision Theory," Measurement: Definitions and Theories, eds., C. West Churchman and P. Ratoosh (New York: John Wiley and Sons, Inc., 1959), pp. 233-269.

substance s from mineral X until X and Y were equal. When this discovery is made, we can then interchange X for Y at will--by adding s; then s would become the unit for hardness on a cardinal scale. The minerals would remain the same as before in all dimensions except hardness. Graphite would still be black, limestone would still be white, but the two could be made equal in hardness by adding s.

This is true in the dimension of length. A cotton cord is different from a steel I-beam in many respects yet they may be made equal in length by adding or deducting feet. If length is the only dimension of interest, all objects can be made equal by the addition of length units. Conversely, two objects of 1 foot each are interchangeable with one object of 2 feet. Likewise, if hardness is our only concern two minerals with one s each is equal to one mineral with two units of s. The minerals, by the discovery of the interchangeability, have been put on a cardinal scale.

In the value dimension an intermediate unit is available to equate the objects. A price--transformation coefficient--may be defined that would leave the chooser indifferent between two objects. Note, however, that one object may be prized more than another even though the price is equal. The chooser may predict that one will "grow" more than the other and therefore hold it more valuable. This again is the result of a prediction which is not amenable to measurement. As in the length analogy above, we have two concepts: (1) The present exchange rate which is subject to measure-

ment and (2) The prediction of an exchange rate which is not.

As above, we can then state that A is more valuable than B and since B has a price of, say, five dollars, then A is more valuable than five dollars. The comparison here, as above, is the expected state of A to the expected state of B. However, all that can be measured at the moment is the present sacrifice of B for A. One is willing to presently give up, obviate, sacrifice, five feet of B or five dollars of B in order to obtain, maintain A which has a value greater than five feet or five dollars. The thing that can be measured univocally is the sacrificed good.

Note, however, that the decision is made on the basis of a prognostication of the benefits of the two goods. Good A is expected to yield more benefit--satisfactions, grow faster--than B and thus it is chosen. We have been tacitly assuming that A and B were discrete, mutually exclusive alternatives. They may not be discrete. For example, 2B may yield more benefit than 1A. We need a unit of interchangeability which will permit A or B to be expressed as continuous in order to equate the two.

This unit is, of course, dollars. There is some ratio at which 1A will exchange for some amount of B. That is, there is some point where the two are presently equal in their exchangeability. This ratio of exchangeability is the transformation coefficient stated in money. Five dollars of A is equal, by definition, to five dollars of B. In terms of the goods however, this equality may be 1A = 2B or 1A = 1/2B or some other ratio. Thus, money

is a general expression of the magnitude of the sacrificed good. For convenience then we may state the sacrificed good in terms of money.

> VALUATION PROPOSITION IV: Value of a good may be measured ordinally by comparing it to the next-best alternative which was sacrificed in order to obtain or maintain the good. For convenience, the sacrifice may be stated in money terms.

There are several temporal classifications of the sacrifice.

1. The past sacrifice. The good that was originally obviated in order to obtain another good.

2. The present sacrifice. The good that is currently being given up in order to maintain another good.

3. The ex ante sacrifice. The expected size, utility, of the goods that will have to be given up in order to obtain, maintain another good.

4. The ex post sacrifice. The present size, utility, of a good that was sacrificed in the past in order to obtain, maintain another good.

All of these viewpoints may be valuable information. Any one or all may be relevant to a particular problematic situation. All, save (4), have been proposed as the proper method of income measurement.

Schindler, in defense of the Accounting Tradition, relies heavily on the concept of sacrifice and excludes other methods because they are not sacrifice concepts. He writes:

> Like the market value concept, it [the Fisher Tradition] is an economic definition of value in sense of "worth" at a given time in the light

> of future expected advantages, rather than a sacrifice concept....That is, value is concerned with the expectations of advantages to accrue from ownership or control of a property...whereas cost is concerned with the sacrifice required to obtain the services of the property.[8]

The author fails to understand why the past obviation of a good is a sacrifice while the present or future expected obviation is not. It seems clear that the only difference is in the temporal viewpoint not in the concept of sacrifice. All are sacrifices but one views these sacrifices from a different point in time. Thus, one cannot choose between them on the basis of sacrifice versus non-sacrifice.

Sometimes writers argue that one of the above sacrifices is the "true" one. For example, one may argue that (4) is the "true" sacrifice because the rejected alternative's ex post size is the amount that was actually given up. This is a truism and is relevant to the verification of the previous prediction (ex ante sacrifice). If the economy allocates resources to project A and rejects project B, it is meaningful to say that the conditional ex post size of B was the actual sacrifice. However, it is equally meaningful, valid to say that the present good given up is the "true" sacrifice. The good that is currently being sacrificed has some amount of utility associated with it. It is true that the utility is a projection and thus may be in error, but this does not negate the fact that this

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[8]James S. Schindler, Quasi-Reorganization (Ann Arbor: Lithoprinted by Braun-Brumfield, Inc., 1958), pp. 85-86.

good is now being sacrificed. Both expected and present obviation are sacrifices; it is only the verb tense that distinguishes them. But, that is a sufficient distinction.

In short all are "true" sacrifices and since valuation is intimately tied to sacrifice they all may be used for valuation. However, the valuation must have the same temporal viewpoint as the sacrifice from which that valuation came. A past sacrifice can yield only a past value, a present sacrifice only a present value, etc. Thus, proposition V.

> VALUATION PROPOSITION V: The temporal modifier of value must coincide with the temporal modifier of the sacrifice.

Thus, we can speak of past values, future expected values, etc., and the temporal referent of the sacrifice will be understood.

Recall, however, that the act of valuation is concerned with the future state of the object. Valuation, the act of ranking and selecting alternatives, has an inescapable forward-looking attribute. Thus, we can exclude sacrifice concept (4) from the valuation process since it is backward-looking. Verification of a prediction is the purpose of concept (4) and verification is always a backward-looking procedure. One can measure the sacrifice ex post but the alternative is no longer available and thus cannot be valued in the same relational sense of deciding between alternatives.

Suppose, for example, that there are two objects, alternatives, A and B, that are presently equal in the relevant dimension.

A is expected to increase at a faster rate than B. At the present moment, t_1, then A is more valuable (to the chooser) than B because A is expected to be greater than B in the future, at t_2. Thus, at t_1

$A = B$ in the relevant dimension (say, feet or dollars)

$A > B$ in value

because of the prediction that

$A > B$ in the relevant dimension

Now if at t_2

$A < B$ in the relevant dimension

i.e., the prediction is wrong, it would be absurd to say that B is more valuable than A. It is true that B is larger than A but the process of valuation at t_2 is the same as it was at t_1. That is, we equate A and B by adding or subtracting units and then make a prediction about the future state. Such a process would then determine the value at t_2.

What can be said about this example is

1. A was more valuable than B at t_1.
2. A was predicted to be greater than B at t_1.
   (which is synonomous with the first statement.)
3. The prediction was erroneous.

The fact that the prediction was erroneous does not change the valuation or the prediction of t_1. It simply verifies it. Thus, sacrifice concept (4) is a "true" sacrifice and may be valuable information--relevant to a problem--but it has nothing to do with valuation.

Sacrifice concept (3) is indispensible to the valuation process but being a prediction it is not subject to measurement.[9] Since we are here concerned with a measurable dimension concept (3) must be excluded.

This leaves only concepts (1) and (2). Both are subject to measurement and both are valuations, the only difference is that one is a past value and the other a present value. Concept (1) is a past valuation, it is concerned exclusively with the history of value and is not relevant to the present value. It is concerned exclusively with a past sacrifice (perhaps the original sacrifice) and this may be relevant information but it is clearly historical information which has nothing to do with the current selection of alternatives.

As in the above example, assume that A was expected to be greater than B and thus it was selected. At t_1 A is more valuable than B. If at t_2 A is selected again (Proposition II) it is still more valuable than B (Proposition III). Since value is measured ordinally by measuring the sacrifice (Proposition IV), any time that B changes in size the value of A changes also. Thus, the value at t_2 can be determined only by measuring B at t_2. The sacrifice at t_1 has no relevance to the value at t_2.

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[9]Even if it were subject to measurement there are problems of equating the future value with the present or past value. This usually is done by discounting but the correct discount rate is not clear even under certainty. See The Fisher Tradition infra.

VALUATION PROPOSITION VI: The current value may be measured ordinally only by measuring the current sacrifice.

This proposition is no different from propositions about the current measurement of any dimension. One can state with little fear of disagreement that

1. The current length may be measured only by the current juxtaposition of meter sticks.
2. The current hardness may be measured only by the current scratching of minerals.
3. Etc.

No botanist would claim that he has a current measure of a growing plant if he had not measured that plant since acquisition. No physicist would claim that he knew the current radioactivity of an object that had not been measured since it was bombarded. No physician would claim that he knew the temperature of his patient on the basis of last week's measurement. Certainly, we can measure some inert, unchanging objects once and then rely on that measurement at other times. But this is a process of <u>adjusting</u> the measurement for its temporal invariance. Time is not a relevant variable in some measurements and therefore does not need specification; if time is a relevant variable, then the measurement veritably describes the dimension only at the one instant when that measurement was taken.

The above is truistic and as plain as anything could be. This makes valuations, both past and present, a "pure measurement"

problem, i.e., it is a problem common to all measurements. If there are objections, then, they must be couched in measurement terms. There may be some difficulty in specifying and measuring the dimension of the sacrificed alternative. Since value is ordinally measured by the measurement of the sacrifice it is clear that any difficulty in the measurement of the sacrifice would cast doubt on the resultant value. However, since the "past" was at one time the "present" and the "present" will soon become the "past" it appears that any difficulties in measuring the sacrifice are equal at all instants. If there are problems in measuring the alternative sacrificed there is no reason to assume that these problems are any greater or less at the present instant than they were at some past instant. It may turn out to be true that the problems are greater or less at certain instants but this is an empirical question; it is a question of fact that must be investigated individually. Until such an investigation is made we will assume that all instants are equally difficult or easy so far as the measurement of the sacrifice is concerned.

This leaves us free to concentrate on the measurement problems of the sacrifice: the dimension, the instrument, the unit, the numbers, etc. In short all of the same problems of measurement that all metricians face, including, but not restricted to, those discussed above.

Summary

We have found that valuation--in the appraisal sense, our context--is the expression of a preference from among competing goods. Goods must be sacrificed in order to obtain or maintain another good. The criteria for the selection of a good--and the rejection of all other goods--are the expected future state-of-being of the goods. Goods are ranked in accordance with this expectation and the value of the selected good may be ordinally measured by measuring the next-best alternative--the highest ranked good that was sacrificed.

Sacrifice may be viewed from several temporal vantage points. All such temporal viewpoints are true sacrifices, but only the present sacrifice is relevant to current valuation. Past sacrifices-past valuations may have useful historical information but they are not pertinent to the present valuation. Any difficulties in the measurement of the sacrifice are assumed to be equal for all past and present sacrifices.

The Problematic Situation

In the sections on Information and Measurement we noted that the "construct" was prior to the "fact" or "measure." Considerable emphasis was placed on this methodological order and one significant conclusion was that the locus of the relevancy criterion is the theoretical construct and, further, that the theoretical

construct was the solution to a particular problem. No general criterion of relevancy (or "value") of information or measurement was possible because of the differences in the problems. This section is an attempt to state the problem in a general way.

The general formation of the receiver's problems is fairly simple. One classification is to state the problem as

1. Information needed by managers relevant to their problems, and
2. Information needed by other interested receivers relevant to their problems.

We are fortunate in that there is a wealth of literature on the first problem. Indeed a large portion of economics and, more recently, managerial economics has been devoted to specifying the information relevant to the goal of maximizing money-profits. We will briefly recapitulate this under the heading of the "Decision Theory of the Trader."

Unfortunately the literature on the second problem is both scanty and scattered. For instance, one of the interested receivers is the creditor and very little has been said about what his problem is and what information he needs.[10] Another interested receiver is government as a taxing authority. There is a large

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[10]We have excluded debt from our model in order to keep the model simple. However, we will include creditors in this analysis so that our conclusions will be general. The addition of creditors to the model changes nothing; it would only require another quadrant which is more cumbersome.

body of literature on Public Finance but most of it is concerned with the "definition" or "equity" or "a welfare function," etc., not with the specification of information. We will attempt a generalization below about the problem and information needed to solve that problem under the heading of "Decision Theory of Other Receivers."

Decision Theory of the Trader

Within the restricted model presented above it is clear that the trader has evaluated all previous alternatives and then decided to become a trader. He could have used his funds for consumption, loaned them at interest, to become a producer, to enter another market, etc. He has ranked all of these alternatives and decided that becoming a trader in the wheat market was preferable.

In evaluating the consumer alternative he has decided that his total utility will be enhanced by entering this market. This may have been done on either of two bases:

1. The usual time-preference analysis, i.e., that his impatience for present consumption is overcome by a prospective larger amount of consumption.

2. Surplus consumable funds, i.e., his utility is increased by delaying consumption due to the declining marginal utility of instantaneous consumption. This is possible even if the prospective future consumption is the same or smaller than the present consumption. A smaller amount of future consumption may yield a larger amount of total utility than a larger amount of present consumption.

Regardless of the reason, he has decided to become a trader instead of a consumer and he will continually make this decision in this analysis. If at any time he makes another decision, our model will not apply and we will lose interest in him.

In addition, he has decided that trading in the wheat market is his best alternative from among competing entrepreneurial activities. This may have been done by some formal minimax analysis, by intuition, by default, etc., but for whatever reason he has evaluated this activity as his "best alternative." This decision must be continued by him for our model to apply; if at any time he changes his mind the analysis of his activities would go beyond the scope of this study.

With these previous decisions assumed, the problem is considerably simplified. As long as this model is his best alternative he has only to decide between:

A. Maintaining his present position.

B. Exchanging (transforming) to a new position.

Stated in a slightly different form, he can decide between:

A. Holding wheat.

B. Holding cash.

From what has been said above it follows that if he holds wheat he values it more than <u>all other</u> alternatives--more than consumption, creditor position, etc., and more than cash. Since this market is his best alternative he values cash more than consumption and other entrepreneurial activities and thus cash is second only to

wheat in his ordinal scale of value. The same can be said of cash but need not be since we have assumed its value to be unity.

Underlying such a valuation is his prediction of the future state-of-being of the alternatives. Making the usual Hedonistic assumption, the alternative with the greatest anticipated increase will be selected.[11] In other words if two alternatives are equal in the relevant dimension currently, the anticipated increment of both alternatives is the basis for the valuation and the decision.

Cash and wheat are equated in the model by the transformation coefficient. That is, the transformation coefficient permits the addition of units which permits the equation of two objects. Thus, if the price of wheat is $2 per bushel then

$2 = 1 bushel of wheat.

With the two alternatives equated we can concentrate on the increase and state that the trader:

A. Will value wheat more than cash--hold wheat--if he expects the increase in wheat to be greater than the increase in cash.

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[11] We have neglected a third possibility; selecting a combination of wheat and cash. The trader, because of uncertainty-risk, may decide to hold such a combination. This, in the recent literature, has been termed the "utility problem." (Cf. e.g., Robert Schlaifer, Probability and Statistics for Business Decisions (New York: McGraw-Hill Book Co., Inc., 1959), pp. 31, 32 and passim. In less technical jargon this is the "risk of putting all of your eggs in one basket." This refinement, while important, is not germane to the problem at hand. It would simply add complication that would eventually strengthen the conclusions. See infra.

B. Will value cash more than wheat--hold cash--
if he expects the increase in cash to be
greater than the increase in wheat.

Since the value of cash in relation to all things other than wheat is constant (the stable price level assumption) this can be stated more compactly.

Maximization Criterion:

Hold wheat only if it is expected that the present transformation rate of cash to wheat will increase.[12]

For the decision it is clear that there are only two relevant bits of information.

1. The future expected state of being of the good.
2. The present sacrifice.

The present transco gives the rate at which he will be required to sacrifice cash for wheat. Thus, the current value of the wheat is the present transco. Likewise, the future state of being of the wheat is restricted to a change in the transco in this model. Thus, in terms of the model these binits are equivalent to

1. The future expected transco.
2. The present transco.

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[12]In a more realistic situation he would sell short--hold negative wheat--if the wheat was expected to be less than the present transformation coefficient. We have excluded short selling for simplicity's sake. Its inclusion would not alter the results. For the nonce, we have neglected any probability distribution in the expectations. It will be included below.

Nothing else is relevant to the decision. Other information may be relevant to the evaluation of past decisions but for the decision at hand--the continuing decision, valuation--these are the only two information bits that have any value to the trader. All other information is irrelevant and thus has zero information content for this specified problem. This is incontrovertible regardless of the verity or any other characteristic that other information may possess. Because of necessity for continually making the decision these two bits are always relevant. They are relevant at all instants in time.

Note that both the relevant information bits are exogenously determined. The trader has no control over, no effect on, the present or future transformation coefficient. These are "givens" to him. The amount of wheat or cash that he can hold is given by the present transformation coefficient. The present sacrifice rate is given by the present transformation coefficient. The prediction of the future transformation coefficient is a composite of predictions about crop yields, weather, etc., none of which are subject to his control. He is at the complete mercy of the market with one single exception: He can control his position on the present transformation coefficient. He can not control the past positions because they are past and he can not control the future position because the alternatives are not yet available. His only decision is his present position on a given line and once that decision is made it is forever irrevocable because that moment will never recur.

In this decision it is important to point out that cash is a "general" alternative--a "general" commodity. Cash is, if wheat is held, the next-best alternative; better than consumption, other entrepreneurial activities, etc. Cash is thus more valuable than, say, consumption but in order for the trader to know this--to make the valuation, decision--he must know the amount of cash that is available to him because there exists other models for consumption, etc., which also have transcos. That is, the cash available is related to the other alternatives and, in order for this cash to be ranked second, the amount of the sacrifice of the third ranked alternative must be known. Thus, the prior decision--to enter this market--has four relevant bits of information:

1. The present transco in the wheat market,
2. The present transco in the third ranked alternative.

These present transcos may be used to equate the two alternatives and then we need

3. The expected future state of the third ranked alternative.
4. The expected future transco in the wheat market.

Comparison of (3) and (4) will yield the decision to enter this market. This decision, like the other, must continually be made so that these bits are relevant at all instants in time.

The Trader's Evaluation of Past Decisions

In the above analysis we have been concerned with the trader's ex ante decision. The trader may want to evaluate his past decisions in order to check the degree of error in his prediction. It is important to emphasize that such an evaluation is neither controllable nor germane, except indirectly, to his present decision. An evaluation of past decisions--the verification of past predictions--may cause an alteration in the construct utilized to make the prediction and thus may indirectly affect his current decision but this does not alter the basic construct for decision making that was outlined above.

The value of verification of this kind lies in checking out the theoretical construct for predictions. The past is evidence that his prediction--and the theory used for the prediction--was either correct or had some degree of error. The prediction took the following form:

At t_1, he predicted--and acted on that prediction--that the transformation coefficient would be X at t_2. Now the transformation coefficient at t_2 can be observed only at or after t_2. If it turns out to be Y then the error in the prediction is

$$Y - X = \text{Error}$$

This is the first step in the alteration of his predictive theory. The error is isolated and he may now check the theory to see if he can determine what went wrong. The important elements for our purposes are the information bits required for the evaluation.

They are:

1. X, the predicted transformation coefficient at t_1.
2. Y, the actual (ex post) transformation coefficient at t_2.

Since this is a continuous decision--valuation--there are serious problems in checking the predictive errors. The trader is making a prediction at every instant in time and presumably this prediction covers an indefinite number of instants in the future. Thus, there will be several, perhaps many, outcomes to compare to each prediction and the number of predictions on a continuum is infinity. If we follow the X-Y approach suggested above then we will have an "infinity prime" number of errors. Clearly this would require a capacity that staggers the imagination.[13] Even if this problem could be solved we would still face the difficulty of weighting the errors to come out with some comprehensible statistical summary.

An additional difficulty in the simple X-Y approach is that the trader probably will not have a definite, quantified expectation

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[13]One of the requisites for a communication channel to handle this amount of data is that the elapsed time between transmission and receipt be zero. Since the prediction is made at every instant, any transmission time longer than "instantaneous" would start a backlog. Since there would be no time at which a prediction was not made--no time at which a message was not generated--this backlog could never be cleared and would increase at a rate determined by the difference between the time required for transmission and the "instant" of the prediction. The backlog would soon overwhelm any channel.

in mind. Instead he is likely to have some tenuous and tentative notion about the direction of the price change. As Keynes puts it

> An entrepreneur, who has to reach a practical decision as to his scale of production, does not, of course, entertain a single undoubting expectation of what the sale-proceeds of a given output will be, but several hypothetical expectations held with varying degrees of probability and definiteness. By his expectation of proceeds I mean, therefore, that expectation of proceeds which, if it were held with certainty, would lead to the same behaviour as does the bundle of vague and more various possibilities which actually makes up his state of expectation when he reaches his decision.[14]

This vague bundle can be formalized by assigning subjective probabilities to the various possibilities and calculating a "mathematical expectation." Such a formalization would take the form of

$$E = P_1(A_1) + P_2(A_2) + P_3(A_3) + \ldots + P_n(A_n)$$

or

$$E = \sum_{i=1}^{n} P_i(A_i)$$

where P is the assigned subjective probability of event i occurring and A is the amount of gain or loss if event i occurs. If E is positive then, the trader has a better-than-even chance of gain. E, however, does not help us in the calculation of the prediction error. It is an abstract number (a mean) the sign of which indicates only the direction of the trader's expectation.

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[14] John Maynard Keynes, The General Theory of Employment, Interest and Money (New York: Harcourt, Brace and Co., Preface dated 1935, no copyright date appears), p. 24.

We could chop time up into arbitrary periods and take predicted direction of change at the beginning of that period and compare it to the outcome at the end. This would yield the number of "successes" or "failures" but would not solve the weighting problem. Success and failure are "classifications" in Hempel's terms and are not as useful as metrical concepts. In other words, the trader may "fail" even though his individual "failures" were much fewer than his "successes." One "large" failure (or success) may offset a great many "small" successes (or failures). Thus, we must have some weighting method.

One method of measuring the prediction method that immediately suggests itself is to take the difference between two completed exchanges. When the trader exchanges, this signals a change in the direction of the prediction and this predicted direction remains constant, although the predicted magnitude may vary, until he makes another exchange. When he exchanges cash for wheat he is predicting an increase in the price of wheat over the current transco. So long as he holds wheat he is continuing to predict an increase over the current transco. When he completes the exchange he changes his prediction to a decrease in price below the current transco. He may make several errors before the completion of the exchange but these will be netted out if the difference is taken between the two exchanges. For example, assume that the trader exchanges for wheat at t_1 and completes the exchange at t_3 with the transcos taking the pattern as in Figure 12.

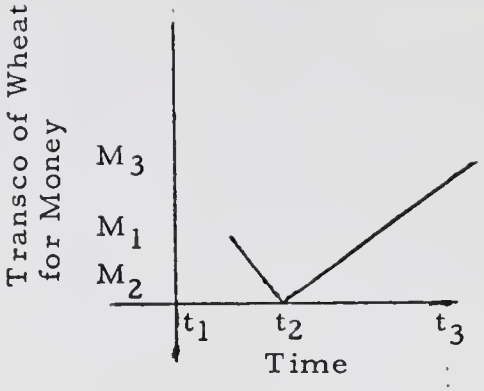

Figure 12

The trader's prediction is incorrect in direction from t_1 to t_2 but is correct from t_2 to t_3. The monetary amount of his error is M_1 to M_2. The monetary amount of his successful prediction is M_2 to M_3 and the net is M_1 to M_3. If we wanted a longer period to evaluate the prediction error we could simply extend the above diagram to whatever time was desired. Thus we could have a pattern as in Figure 13.

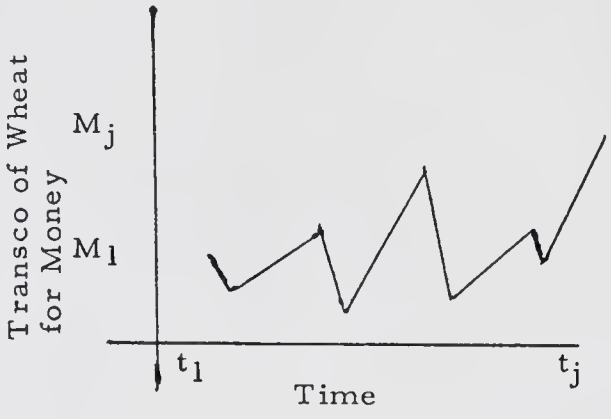

Figure 13

and the difference between M_1 and M_j is the net of the prediction error from t_1 to t_j.

Note, however, that the only requirement for the measure-

ment of this error is that the time must have elapsed. That is, we are verifying a prediction and the only requirement for the verification is that the data become available. If t_j has arrived the data are available regardless of the state of the exchange. Thus, the prediction error may be measured at t_j even if the exchange is incomplete. This is permissive; there is no good reason to exclude the transco at t_j. But, there are powerful reasons to include it. In fact, it makes no sense to speak of measuring the predictive error from t_1 to t_j unless the t_j transco is included. One could arbitrarily cut off the time back at say, t_3, but this is a measurement from t_1 to t_3 not from t_1 to t_j. Presumably, one would want to include all predictions and verify all of those for which the data were available. Any cutoff prior to t_j arbitrarily excludes the latest predictions.

Thus, we can say that the evaluation of a series of decisions requires two bits of information:

1. The past (entry) transco.
2. The present (latest) transco.

Note that the evaluation of the next series of decisions must begin with the last transco of the last evaluation. If the data are to be linked, continuous, without gaps, the time periods must be contiguous. This linkage may be accomplished by simply picking up the latest transco that was used in the previous evaluation. The two bits may be stated more generally as

1. The latest transco used at the last evaluation.

2. The present transco.

So far we have been concerned with the evaluation of the decisions in the case of an incomplete exchange. If the exchange becomes complete in interim it makes no difference, requires no more information, than that specified. If per chance the exchange is complete at either the beginning or end of the time period under analysis then the amount of money held is substituted for the pertinent transco. It is obvious that these coefficients need quantities. We need to know the quantity of both money and wheat--his "position"--at the pertinent instants, in order to calculate the total value.

Once the trader has measured and netted his predictive errors in the fashion described, the only additional need is a standard for comparison. There are several conceivable standards:

1. The net result if all predictions had been perfect.
2. The net result of the next-best alternative.
3. The net result of another trader in the same market.

We will not presume to prescribe the standard to be used. However, we will specify the information for all three standards. Standard (1) requires nothing more than a listing of the peaks and troughs in the above diagram. Standards (2) and (3) require the measurement of the net result of either the next-best alternative or the other trader. Note that this is an <u>instantaneous</u> comparison and

therefore requires that the measurement be made at the same time. This is another compelling reason for using the present transco. The next-best alternative is a counterfactual conditional and thus there are no completed exchanges for comparison. The other trader has completed exchanges but it would only be in the rarest of circumstances that the completed exchanges of both traders coincided.

Summary

We have analyzed three problems of the trader.

A. The continuing decision to enter and stay in this market.

B. The continuing decision to hold either cash or wheat.

C. The evaluation of past decisions.

The purpose of this analysis was to specify the information relevant to these decisions. We found that these were

1. The expected future transco of this market.
2. The expected future transco (state) of other alternatives.
3. The present transco of this market.
4. The present transco of other alternatives (including the perfect prediction counterfactual).
5. The (latest) transco extant at the last evaluation.
6. The position (quantities of wheat and money) at the last evaluation.

7. The present position.

Other models exist for the generation of binits (2) and (4) and thus we may exclude them from further consideration. (5) is a "past present" transco that is used as a linkage between two time periods. (1) is relevant to decision A and B. (3) and (7) are relevant to all the trader's decisions. (6) and (7) are the multiplicands to get the total value.

Decision Theory of Other Interested Receivers

We have made a broad classification of two types of receivers--(1) the trader, and (2) other interested receivers. The trader's decision theory was discussed above and the purpose of this section is to discuss the other interested receivers.

The prime distinction between these groups is in the control that they have over the position on the transformation curve. The trader may decide on a position and then exchange in order to obtain that position. The other interested receivers have no such control; they are passive observers of the trader's decisions. This is the usual distinction between "management" and "others." Managers have control of the assets of the enterprise. Others observe the results of the manager's decisions passively.

In a realistic situation, the "others" would include creditors, owners (as opposed to managers), employees, and government. All of these have some degree of authority over the enterprise but it is of a generalized type that imposes broad constraints, restraints

instead of specific directives. For example, the creditors may limit expansion or even cause contraction by refusing to lend or by calling in their outstanding loans; owners may replace the managers; employees may stop operations by a strike; government may require payments for the privilege of continuing operations or impose general restraints by law. Such authority may be classified broadly as:

A. Prior restraint. The broad "rules of the game" within which the managers must operate.

B. Decision consequences. The rewards or penalties, usually financial, which are imposed because of the results of the enterprise's activities.

We will take the former as given in this study and concentrate solely upon the latter. Every enterprise is subject to certain kinds of control by law, custom, ethics, fear of future reprisal, etc. There are rules which govern the relationship to employees, customers, public, etc., which may or may not be formalized. The sanctions imposed may vary widely: penal servitude, economic deprivation, social ostracism, etc. These rules and their enforcement are indispensable to every society, but they come about from a complex set of social mores that are not germane to the study. It is true that the society needs veritable and relevant information to impose, alter, enforce, such rules, but the problem of specifying such information is insurmountable without a complete

exposition of social, economic, political, etc., constructs and problems of the culture. Obviously, this task is beyond the possibility of any single study. As a result, we assume that such rules are "constants" for the purpose of this paper and hope that the conclusions reached will be of some use to the culture at large.

The latter--managerial decision consequences--have a direct bearing on the subject at hand. Certain receivers need information to make immediate and direct decisions affecting the enterprise. The creditor needs information to decide whether or not to grant or extend credit; the taxing authority needs information in order to levy equitable taxes; the employees need information for bargaining purposes, and so forth. This type of decision may be further classified into two broad categories:

1. Those decisions based on the past activity (which yields the present status) of the enterprise.
2. Those decisions based on the expected future of the enterprise.

Examples of receiver interest in the former are such questions as: ability to pay dividends, to pay off a loan, equitable amount and ability to pay taxes, etc. Examples of the latter are questions about investing for a future return, lending now, etc.

Many of these questions are difficult to delineate. For example, the ability to pay dividends is inextricable from the problem of investing, since the absence of withdrawal is, in effect, the

same as a positive decision to invest. Nonetheless, we attempt to separate them for the sake of the clarity of presentation.

We classify these receivers as "interested" because they need to make these decisions concerning this enterprise. If at any time, they are not required to make decisions about the enterprise, we will classify these as "disinterested" or "receivers with idle curiosity" and abandon them.

Decisions Based on the Expected Future

We saw above that the decision of the trader was a process of ranking alternatives. We first needed to equate the alternatives and then predict their future state. The other receivers have the same problem and the same process. They have alternatives that must be equated and then ranked according to prognostication of the future. Thus, the first listing of information is:

1. The present sacrifice. (The equation of the alternatives)
2. The expected future state of the alternatives.

The difference is that these receivers are ranking enterprise versus enterprise--assuming for the nonce, that they have ranked, and rejected, consumption, holding money, etc.--instead of wheat versus money. They have decided to invest their funds[15] in an

[15]In case of the government or public, they have decided to utilize their resources.

enterprise rather than consume or hold them in a riskless state (i.e., cash). Thus, the choice is between two enterprises, A and B.[16]

The first problem of the receiver is to equate the two enterprises, and this will determine his sacrifice. Obviously, the enterprises should be equated at the present moment; the past size of the interprise is irrelevant to the present equation. There exists some exchange rate--transformation coefficient--that will permit the equation of these two objects by first comparing each to a unit and then comparing the units. This unit, of course, is money, and we can express the sacrifice in dollars as we did above. This is an instantaneous comparison, and therefore the measurements must be made at the same time. Thus, the first bit of information can be stated as:

1. The present transco between enterprises.

Underlying this transco between enterprises is the transco of the elements of the enterprises. That is, suppose the alternatives are A, an enterprise in the wheat market, and, B, an enterprise in the corn market. The exchange of A for B is essentially

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[16]Of course, the two top alternatives could be assumed to be between enterprise investment and money, as it was with the trader. However, if we did this, we would need to then rank cash with another enterprise to make the point. Since we have already made the case for cash versus wheat above, we are here ranking the enterprises for the purpose of brevity and variety. It will become apparent to the reader that the conclusion would be the same.

an exchange of wheat and/or money for corn and/or money. We are here concerned with exchanging enterprise for enterprise, so the quantity of the commodities as well as the transcos are again relevant. Since the present transco between enterprises is the one in question, it is obvious that the present transco of the commodities is appropriate. Thus, the elements of the transco between enterprises are:

1. The present transco of the commodities.
2. The quantity of the commodities.

We are here interested in the abstracted transco of the enterprises which is the total of the elements. We can define

P_m = the transco of money to money

Q_m = the quantity of money

P_w = the transco of commodity to money (wheat, in this case)

Q_w = the quantity of the commodity,

and

$$X_a = P_m Q_m + P_w Q_w \qquad \text{(eq. 1)}$$

but P_m is the measurement unit, and by assumption as well as by implication of the name, it is unity. Thus, eq. 1 can be shortened to

$$X_a = Q_m + P_w Q_w \qquad \text{(eq. 2)}$$

X_a is now stated in the measurement units--has a dollar sign--and the same can be done for enterprise B, X_b.

Once this has been done, the ratio of X_a to X_b yields the

transco between the enterprises. One can equate the two by adding or subtracting units, Q_m. This is to say, by varying the second term of eq. 3.

$$\frac{P_w Q_w}{P_c Q_c} + \frac{Q_{ma}}{Q_{mb}} = 1 \qquad \text{(eq. 3)}$$

or if the elements are not known, by solving for Q_m in eq. 4,

$$\frac{X_a \pm Q_m}{X_b} = 1 \qquad \text{(eq. 4)}$$

the two enterprises can be equated. The terms of equation 3 are the elements of information that go to make up the present transco between the enterprises. These elements may be stated more compactly as:

1. The position of the enterprise.
2. The present transco of the commodities in question.

The "position" refers to the point on the curve from which the quantity of cash and the commodity can be determined.

The second bit of information--the expected future state of the alternatives, enterprises--is more complicated. The difference between the other receivers and the managers is the control or lack of control that they have over the position of the enterprise. The manager has the ability to control the position of the enterprise; the other receivers have no such control.

The manager is one of the important variables in the other receivers' prognostication of the future state of the enterprise.

The success of the enterprise depends upon the manager's decisions; therefore, the other receivers' predictions must be ad hominem. This may take two forms:

1. Comparison of predictions. The other receivers may make a prediction (about the price of wheat) and compare their prediction to that of the manager's.
2. Prediction of the manager's success. The other receiver may attempt to make a judgment about the likelihood of the success of the managers.

The former course of action requires a decision model identical to that of the trader. The other receivers can stand in place of the manager and say in effect, "If I were the manager, I would act in X way because my prediction is Y." We concluded above that the relevant information for this decision is:

1. The present transco
2. The expected future transco.

The only additional bit of information needed for the comparison is the manager's expected future transco. They need to make the prediction and then compare it to the manager's prediction; thus, the total information needed is:

1. The present transco (applicable to both the manager's and the receivers' prediction).

2. The expected future transco of the receivers.

3. The expected future transco of the managers.

If there is a variation in the expected transcos, the receivers consider theirs to be correct, else they would not hold it, and the manager's to be incorrect. They can weight the variation in some fashion and make the decision about credit granting, management replacement, etc.

The difficulties of stating the prediction of the future transco in anything other than direction were noted above. These difficulties are compounded here because of there being two predictions, and also because the manager's prediction would have to be communicated. The escape from this dilemma above was to use the direction of the predicted movement rather than a quantified magnitude of the movement. For the same reasons we will follow the same process here. Thus, the information bits may be restated as:

1. The present transco
2. The direction of the change that the manager expects.
3. The direction of the movement that the other receivers expect.

Note, however, that the direction of the movement expected by the manager is indicated by his present position. If wheat is held the price is expected to increase and vice versa. Thus, the same information is given by:

1. The present transco
2. The present position
3. The direction of the movement that the other receivers expect.

These bits are relevant at all instants in time because the other receiver's decisions are, like the manager's, continuous.

The second method--prediction of the manager's success--may be selected because the other receivers want to avoid, or feel incapable of, making a prediction about the price movement of the commodity. Or, they may commit their funds for a fixed time period so that their decision is irrevocable for the stated period in the absence of a secondary market. In either case, these receivers are at the mercy of the manager and they need a method of comparing their "confidence levels" between managers. That is, they need to estimate, predict, the ability of the manager to make decisions in the future.

We will assume that this prediction is made on the basis of using the past as evidence for predicting the future. There are several problems in our assumption, however. It may be that receivers actually make this prediction on some other basis--intuition, hearsay, unarticulated hypothesis, astrological signs, etc. Even if they do follow our assumption, there is no way to prove that the 'past-is-evidence-of-the-future' method is superior

to, say, astrological signs. As Keynes[17] points out, the future can be projected on the basis of the past only by making an unproved assumption about the "uniformity of nature."[18] Suffice it to say that we assume that other receivers make the assumption. If they do, the following is relevant; if not, the other methods require information that is not generated by the model and hence are irrelevant to this study.

The procedure may be broken down into two parts:

1. The gathering of evidence about the past.
2. The projection into the future.

The method used for projection is of no interest to us. The process of gathering the past evidence involves exactly the same problems as those met by the trader in evaluating his past decisions. The other receivers will need some method of measuring the errors of the past decisions, summarizing and weighting those errors and then

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[17]"It may be useful to give the reader two examples, more familiar than the Inductive Hypothesis, where, as it appears to me, such knowledge is commonly assumed. The first is that of the causal irrelevance of mere position in time and space, commonly called the Uniformity of Nature. We do believe, and yet have no adequate inductive reason whatever for believing, that mere position in time and space cannot make any difference. This belief arises directly, I think, out of our acquaintance with the objects of experience and our understanding of the concepts of 'time' and 'space'."
John Maynard Keynes, A Treatise on Probability (London: Macmillan and Co., Ltd., 1948), p. 263.

[18]Also see supra where we discussed Hume's, Russell's and Malcolm's view of the future.

a standard of comparison. The standard for comparison in this case would be the manager of the next best alternative enterprise. Thus, the information bits are, as above:

1. The latest transco at the time of the last evaluation.
2. The present transco.
3. The respective positions.

and these bits are needed for both enterprises.

Decisions Based on Past Activity

As we noted above, the distinction between decisions based on the past and on the expected future are difficult to delineate. We have already overlapped by discussing the history of past decisions above. The questions left fall mainly into the category of "ability to pay" or "liquidity." For example, the receivers may have invested in, or loaned to, the enterprise at some time in the past. Their question now is concerned with the enterprise's ability to return their investment or loan.

This does not involve the question of continuing the investment or loan. There is no difference between continuing an investment, loan, and the refusal to withdraw that investment or loan, if that alternative is available. As pointed out above, these decisions are based on the future state-of-being.

If the decisions involve the net results of the activity since the original investment, the evaluation of the trader's past decisions

presented above would be appropriate. Thus, the questions must be concerned with the state of the enterprise. That is, these questions are not concerned with the changes in the enterprise over time but are instead concerned with the state at a given moment in time.

Specifically, the questions are

1. Is the state of the enterprise such that it can perform "X" act?
2. Can the enterprise fulfill the obligation that it entered into at some time past?

Some of these acts may have specified conditions for them to become applicable. For example, time must have passed for a debt that has a temporal location to become due, income must exist before it can be distributed or taxed, etc. Thus, the first binit that is necessary is the particular factual conditions of the contract or obligation. We will assume that these conditions have been met. If they have not been met, there is no problem, or the problem is one of prediction. Once the problem is stated in this manner, the verb tense implies the answer; the non-predictive state of the enterprise can only be the past or the present.

It seems perfectly clear that the past is irrelevant. Suppose that a debt was contracted at t_1 that became due at t_2. At t_2, then, the interest of the receivers is in the ability to collect the debt. Presumably, it will be collected in money[19] so the ability

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[19]Even if it were paid in wheat, the present transco would be

of the enterprise to repay the debt is determined by (1) the quantity of money held at t_2 if the exchange is complete, or (2) if the exchange is incomplete, the quantity of money that can be obtained by transforming wheat to money. Obviously the relevant transco for transforming wheat to money at t_2 is the transco at t_2. All past and future transcos are not available alternatives. Now assume that the debt was not collected at t_2. The possible reasons for it not being collected are two:

1. The enterprise was unable to pay.
2. There was mutual agreement to postpone.

If the enterprise was unable to pay, the receiver has already received this information at t_2. If he receives it again, say at t_3, it is redundant; it adds nothing to the information that he already has. Even if by some chance the receiver did not know that the enterprise was unable to pay at t_2, that message may have some useful historical information, but it has no relevance to the problem at hand. The problem is to collect the loan and the transco at t_3 is the only relevant transco for that problem. If there were mutual agreement to postpone, this is the same, in effect, as a new loan with a new due date, t_3. The relevant information for a new investment is outlined above; the relevant information at t_3 is the same as at any other due date.

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relevant. There is no reason to assume that the creditor would take a quantity of wheat smaller than the quantity he could purchase (the present transco) if he had been paid in money.

Since the "position" of the trader yields the quantity of both the wheat and money, we list the relevant information as

1. The position of the trader.
2. The present transco.

The Problem of Income Taxation.--The government is currently an interested receiver of information from every enterprise. It requires the enterprise to report the results of certain activities and the quantification of these activities is normally referred to as "taxable income." For the most part taxable income is defined as the cash difference between completed exchanges. Clearly then the government has different relevant binits from those specified above. Thus, a critic may argue that our analysis is incomplete unless we discuss taxable income. For this reason we will digress in an attempt to justify the exclusion of taxable income from our relevant binits.

First, the concept of taxable income has not been excluded. In the above analysis we listed as a relevant binit the occurrence of any act which places the enterprise in an obligatory position. A completed exchange is one such act that is relevant to a government that levies taxes on that basis. However, this is only one of a great many acts that are relevant. Governments also levy taxes on the basis of sales, employees and their earnings, property values defined in a particular fashion, use, possession of certain commodities, being "in business," manufacturing certain commodities, transportation across political boundaries and so forth. Each of

these are relevant binits to the government and must be reported. We consider each of these binits to be simply one "factual condition" that is required to be reported and have omitted the impossible task of listing all of them.

Other receivers have similar relevant binits. For example, there are "income bonds" that define income in a certain fashion, some creditors require an accumulation of cash in a trust fund. Most states have a law about dividends being payable from surplus and then they define surplus (income) by statute or precedent. All of these are relevant binits that we have excluded.

Even if we limit the specification of binits to those of taxable income we would have an impossible task. We made the over-simplification above of equating taxable income to completed exchanges. This is not quite true. For example, the exchange of "inventory" for a "marketable security" is a "realization" but the exchange of land for cash may not be. The exchange of a machine for another like machine cannot be considered a realization but the exchange of a machine for cash must be in most instances. The exchange of inventory for a 20-year bond is a realization but the exchange of inventory for an installment note is not. Thus, even if we limited the specification of binits to taxable income it would require the reproduction of the Internal Revenue Code and related court decisions and interpretations.

Our second reason for excluding taxable income is more fundamental. All of the above factual conditions have one element

in common. They are all definitions, either statutory, contractual or precedent. The government being sovereign can levy taxes any way it sees fit, i.e., it can define income any way it sees fit and then base the tax on that definition. There is controversy over the manner in which the government should define income but all would agree on the manner in which it did define income. It appears that the legislatures accepted the prevailing method of measuring income and codified it. This method, of course, was the Accounting Tradition. Since then the legislatures have been willing to follow the changes in accounting theory. Witness the change to allow Lifo, Nifo (during the Korean War), declining depreciation and so forth.

Given the fact that the definition of taxable income is subject to alteration because of theoretical refinements, it is clear that the development of our theory should not be prejudiced by the current definition. In addition, one of the alternatives being examined is the Accounting Tradition and therefore if we allowed our conclusions to be influenced by present tax law--which is based on accounting methodology--our reasoning would be circular.

Finally, we can note that taxation theory falls into two broad (oversimplified) categories: (1) the cynical theory and (2) the equitable theory. The cynical theorists argue that the main business of taxation is to garner revenue for the government and that any tax which performs that function is a good one. Other objectives--e.g., equity, redistribution, ability to pay, fiscal policy--should be subordinated to the main purpose of garnering

enough revenue to provide the governmental services. These other objectives, the argument goes, are separate problems and should be treated as such. The equitable theorists argue that taxation is inextricably intwined with the other objectives and that tax policy must be based primarily on "equity" or "justice" coupled with a large dose of fiscal policy.

This distinction is very roughly drawn, of course, and probably no single theorist would fit in either category. However, the distinction is sufficient for our purposes. If one is a cynical theorist, the current definition of taxable income is a good one because it produces revenue. Note, however, that a tax based on the numerosity of windows would be equally good if it produced revenue. That is, the concept of income is not germane to the cynical theory.

The equity theorists all agree that the current definition is imperfect. Both Haig and Simons in 1938-39 went to great pains to prove that the completed transaction method results in inequities. Other theorists have continued this argument up until the present time. There was a panel on "Capital Gains" taxation at the 1963 American Economic Association Meeting which reached the same conclusion. That conclusion is that income should be based on valuation at current market in order to avoid inequities in taxation.

This study has not utilized equity as a criterion and therefore the analysis is not pertinent. The central point is that, since the

cynical theorists ignore income as a criterion and the equity theorists want to change the definition, there is no reason from a public finance point of view to pay any particular attention to the current definition.

This rather lengthy digression has had the object of meeting the anticipated criticism that our analysis was incomplete. We have argued that the binits specified by the current definition of taxation income should not be separately specified because

1. It is only one of a myriad of factual conditions and has no a priori higher status than any of the others. It would be impossible to list them all.
2. The definition of taxable income results from the theoretical construct of income and therefore should not be a factor in a theoretical analysis.
3. The taxation theorists argue that the current definition is either irrelevant or incorrect.

For all these reasons we ignore taxable income in our analysis.

Summary

We have analyzed the problems of the other interested receivers and found them to be similar to those of the trader-manager. The main difference is that the other receivers are at the mercy of the manager because he has control over the position.

There are two lines open to them. They may either

A. Make predictions continuously and compare their prediction to the managers, or

B. Make an ad hominem judgment about the manager.

If (A) is selected, they must make the same type of decision as the manager and need the same binits, viz., present and predicted transcos. In addition they need to know the manager's prediction which is given, in direction, by the present position. If (B) is selected, they need an evaluation of past decisions and some method of projecting the future. The method of projecting the future is not pertinent. The binits needed for the evaluation are the same as those needed by the manager, viz., present transco and position and latest transco and position at the last evaluation.

In addition, the other receivers may have some contractual or statutory relationship to the firm. If so they need to know the factual conditions of that relationship and the ability of the firm to meet its obligation. The binits needed for the latter are the present transco and position.

A complete listing of the binits relevant to the decisions of the other receivers are as follows:

1. The present transco.
2. The present position. (Yields the predicted direction of the transco movement.)

3. The latest transco at the last evaluation of decisions.
4. Their own prediction of the future transco.
5. Particular factual conditions.

Information needed from the next-best alternative enterprise would be the same as that listed.

Summary

We have found that the dimension of value--in its verbal sense of valuation--is concerned with the ordering, ranking of goods. The problem arises from the necessity to sacrifice one good for another and that sacrifice is the basis for the ordinal measurement of value.

The problematic situation that the trader and other interested receivers find themselves in is one of valuation. They need to make a decision which involves the ranking of goods. The ranking process requires a prediction of the future-state-of-being of the competing goods. The choice is simplified if these goods can be equated in the relevant dimension prior to the prediction and this equation of goods allows a univocal measurement of the sacrifice.

The trader and other receivers may also want to evaluate the past decisions and/or determine the present state of the enterprise. This involves determining the present state of the enterprise

at two points in time (or one point if the present state is the interest) and using the difference as an estimation of the prediction--valuation--decision error.

One bit of information is relevant to all these decisions: The present transco. Other bits that are relevant to one or more, but not all, decisions are

1. Expected future transco direction.
2. Past and present positions.
3. Past transcos.
4. Particular factual conditions.

The past transcos and positions have a specific temporal location: The latest used at the last evaluation.

The next-ranked alternatives have similar models and the information needed from them is the same as from this model.

CHAPTER VI

THE CONSTRUCTS APPLIED

In the preceding pages we have discussed our problem in relation to measurement and information theory in rather general terms. It is the purpose of this chapter to become rather more specific; to examine the alternative valuation coefficients in light of the conceptions and propositions presented above. We will proceed by trying to discover a method of ranking the information in the model and then to an examination of the measurement problems.

Information in the Model

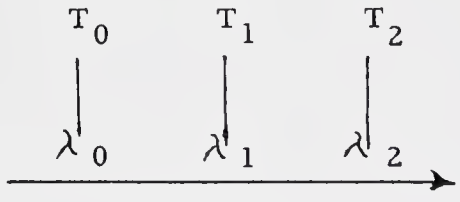
In our simplified model there are a limited number of binits that can be communicated. We will enumerate all of the possible bits and then make judgment about which of them should be communicated. We will set up a method of valuing information bits according to their relevancy to constructs and problems. The assumption that the information is veritable still holds so that we can concentrate on the relevance.

The Communication System[1]

[1]The communication system here described is concerned with

For the purposes of enumerating the bits, we will assume a perfect communication system. There is no noise, loss or inherent capacity restraint. Our goal, however, is to maximize binits--present all relevant information--and minimize capacity.

The transmissions will be sent at definite time periods, T, determined by the desire for information. For simplicity, the time intervals will be assumed to be equal. A series of messages, λ, can be visualized as



The messages will be cumulative in information so that any binits transmitted in, say, λ_0 need not be repeated. There is no noise, therefore redundancy would not add to the information of the receiver but it would of course increase the required capacity. Thus, the last message is concerned only with events since the preceding message. Message λ_2 is concerned only with events from T_1 to T_2, since message λ_1 provided information about the previous periods.

The interim instants are defined as t_1, t_2 ... t_n. The

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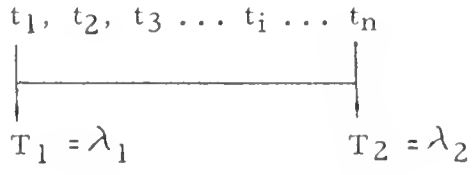
the problems involved when the transmitter and receiver are different persons. Self-communication is not included in the system.

instants between messages are all-inclusive--they include all instants in time--and the first instant, t_1, and the last instant, t_n, correspond to the instant at which successive messages are sent. This may be visualized as



Message λ_2 includes all t's since T_1, λ_1. There are an infinite number of instants, t's, between messages, and thus we should select in order to save capacity. This can be done without sacrificing binits by transmitting states-of-being with the time specified and then making it known that such a state remains constant unless another binit is transmitted. Thus, a message containing

1. State Z_1 at t_2
2. State Z_2 at t_4

would be understood to mean

State Z_1 came into existence at t_2

and remained in existence until t_4 when

State Z_2 came into existence.

Thus, if the bit

State Z_1 at t_3

were transmitted, it would not add any information, i.e., it would

be "prolix."[2]

Binits in the Model

We will classify the information emanating from the model as (1) Positions and (2) Transcos. "Position" refers to the quantities of both wheat, Q, and money, M, in bushels and dollars, respectively. Transcos, P, refers to the transformation coefficient of money for wheat. Money is the valuing agent so the transco refers only to wheat and the "value" of money is unity. Thus, there are three binits:[3]

1. P, transco of money for wheat.
2. Q, quantity of wheat in bushels.
3. M, quantity of money in dollars.

There could be an infinite number of these binits since they could change at every instant in time. We will indicate the time of each, e.g., $Q(t_1)$. All of the t's are in the past, since the present is defined as t_n.

The trader's position--the quantities held--are included in the information enumeration and thus the expected direction--

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[2]We use "prolix" here to avoid the technical interpretation of "redundant." Redundancy, in information theory, is used to indicate the amount of repetition necessary to overcome noise. Thus, redundancy adds to the information received. We mean by prolix that it is unnecessary repetition.

[3]Recall that the valcos are either past, present or future expected transcos. Hence there is no need to enumerate the valcos as separate binits.

the prediction of the trader--is included. The difficulties of stating the prediction in anything other than direction were noted above. The other receivers' predictions are not relevant to anyone's decisions but their own. Since they are both the source and receiver of their own prediction, no communication other than self-communication is needed.

A rather detailed example will be helpful in visualizing the bits of information. Suppose that from T_1 to T_2, the events of Figure 14 occurred.

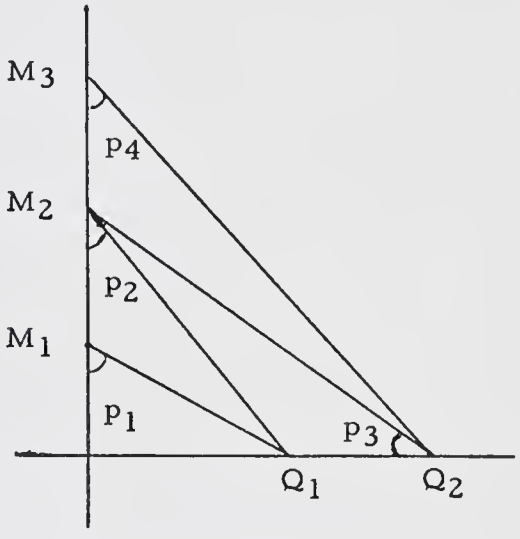

Figure 14

The times and corresponding events of Figure 14 are listed in Table I.

The requirement of λ_2 is that it communicate all of the above information--that the receipt of λ_2 permits the receiver to reproduce Figure 14 and Table I. One way of doing this is to

Table I

Messages	λ_1				λ_2
Time	$T_1 = t_1$	t_2	t_3	t_4	$T_2 = t_n$
Quantity of Wheat	Q_1	-0-	-0-	Q_2	Q_2
Transco	P_1	P_2	P_3	P_3	P_4
Quantity of Money	-0-	M	M	-0-	-0-
Value of Money	1	1	1	1	1
Expectations	Up	Down	Down	Up	Up

transmit all of the above as it appears. However, in order to minimize utilization of the channel, we can "encode" the above in accordance with the assumptions.

The last two rows can be omitted because of the unity assumption and the fact that the expectations are given by the holdings. The cumulative assumption allows us to omit all of Column 1. The event assumption permits the elimination of all repetitions in the rows and the times in which no event occurred.

The final encoded message would contain the ten binits listed in Table II. Without calculations or further assumptions, these are the minimum number of binits that permit the reproduction of Table I and Figure 14.

We can generalize the binits as

1. Two quantities and one temporal instant at every exchange.

Table II

Time	Quantity of Money	Quantity of Wheat	Transco
t_2	M_2	-0-	p_2
t_4	-0-	Q_2	p_3
t_n			p_4

2. One transco and one temporal instant at every price change.

3. The time of the message.

Defining

m = number of exchanges

n = number of price changes

β = minimum binits per message necessary to reproduce all the events,

then,

$$3m + 2n + 1 = \beta$$

This is a general expression of the number of binits required to reproduce the entire history of the enterprise, its exchanges, positions, price changes and the expectations of the trader. Any further shortening of the message will have to be done at the expense of some information. If the capacity is not large enough to allow the full message, the problem is one of selecting the bits to be transmitted.

Measurement of the Value of the Bits

We have discussed the problems above in terms of the receivers. Since there are common elements to each of the receivers, we may recast these under problem categories.

Problem A: The problem of choosing between alternatives.

i. The first problem, as we have set it up, is to eliminate lower ranked alternatives. This is done for conceptual convenience so that we may focus on the last two alternatives.

This problem is universal. It is common to all receivers. We conceive all other alternatives as having a model exactly like the one presented.

This is a problem of valuation and requires the projection of the future state-of-being of both alternatives. It also requires the sacrifice of one of the present alternatives. Thus, the present alternatives and the projection are relevant bits of information.

Value may be measured ordinally by measuring the sacrifice. Thus, if one selects alternative A (the wheat market, enterprise A), we can say that it is more valuable than alternative B, C, D ... n. The value of A is given

by this expression

$A \succ B$ (B is the next ranked alternative)

The sacrifice required is given by

$A' = B$

It is convenient, although not essential, to have a method of equating the alternatives. This requires a unit and since money is a general alternative, it was selected. In terms of the models then, we need the following bits of information:

Model (Alternative) A	Model (Alternative) B, C ... n
1. The present transco	1. The present transco
2. The present position	2. The present position
3. The expected future transco	3. The expected future transco

It is important to emphasize that this is a general alternative and the above bits are relevant to all the receiver's problems.

The other receivers may have a more abstract transco in mind (transco of enterprise for enterprise), but the elements of that transco are those listed above.

ii. Once the general decision is made, we can focus

on the alternatives within the model. The trader must decide between holding cash and holding wheat. If the other receivers select the comparison of predictions method, they also make the same decision. The information bits needed for both are:

1. The present transco
2. The present position
3. The expected future transco

Problem B: The problem of evaluating past decisions.

The purpose of the evaluation of past decisions varies with the receiver. The trader may make such an evaluation in order to revise, improve, the construct used for alternative selection. The other receivers may make an ad hominem prediction and may want a history as evidence for a projection. Although the purposes vary, the problem of both groups is identical. The main difficulty is in summarizing, abstracting the data. We selected a method of measuring the net results of all predictions and then comparing these results to a standard. The information needed is

1. The latest transco at the last evaluation.

2. The latest position at the last evaluation.
3. The present transco.
4. The present position.
5. The standard.

If the standard is an alternative enterprise or an alternative trader in the same market, the information required for the standard would be the same as that listed above.

Problem C: The problem of fulfilling obligations.

This can be further divided into two parts:

i. Determination of the factual conditions of the obligation.

Has the event occurred which causes the obligation? This event may be a wide variety of things--as many as the fertile mind of contractors can dream up. However, the more common are

a. The passage of time (creditors).
b. The earning of income (owners, government).
   One may define this in any way he chooses. The current method is the net results of the completed exchanges.
c. The performance of services (Employer).
d. The value of property (property tax).

ii. The ability of the firm to meet the obligation.

This is concerned with liquidity.

The information relevant is

1. The present position.
2. The present transco.

Finally, we can recast these into binits that are relevant to the problems listed.

Table III

Problems / Binits	Problem A	Problem B	Problem C_i	Problem C_{ii}
1. The Present Transco	x	x		x
2. The Present Position	x	x		x
3. The latest transco at the last Evaluation		x		
4. The latest Position at the last Evaluation		x		
5. Factual Conditions of Obligations			x	
6. The trader's expectations	x			
7. The receiver's expectations				
8. The standard for comparison		x		
9. Bits from other Models	x	x		

Rows 8 and 9 can be eliminated from consideration of information emanating from this model. The relevant binits from the other

models, standards, would simply be a repeat of the same binits from this model. Row 7 is a binit that the other receivers generate, originate and is not germane to this communication system. Row 6 is a redundant binit because the direction of expectations is given by rows 1 and 2. Rows 1 through 5 emanate from this model and are relevant to the problems specified.

Classification of the Receivers.--There are an undetermined number of receivers, n, who receive messages emanating from the model. We have above discussed the commonly accepted constructs that they may have. There are undoubtedly other receivers who have other constructs. The first classification, then, is to divide n into (1) the receivers with the commonly accepted constructs listed above, S, and (2) the receivers with other constructs, C. Thus, we have the problem of receivers with different constructs.

It is impossible to determine how many receivers are in subset C. To anyone who has ever tried to teach the sunk cost notion, it is obvious that there are a great many people who cling, with a fierce tenacity, to original cost as the most important datum in decisions. One can only speculate about how much of this is caused by the current method of reporting economic data in terms of original cost. But, for whatever reason, the fact that such a construct exists is a serious problem in selecting the information to transmit.

There are other receivers who play numerological games with price patterns, e.g., "heads and shoulders," "flags," "pennants," "double bottoms," etc. The author once met a lady who speculated on the sole basis of arthritic pain, and she was quite successful.[4] No doubt there are a great many other constructs, too numerous to list. The point is, however, that there are different constructs within subset C as well as between C and S. Let us further classify the receivers as (1) those with a construct that has original cost as a datum, C_1, and (2) the receivers with other constructs, C_2.

The task of furnishing information to C_2--everything from astrological signs to "flags"--is overwhelming. Luckily, this information does not emanate from the model and is thereby excluded from our communication system.

This leaves us with the receivers in subset C_2. Our task is to rank them in relation to receivers in subset S. There is no a priori method of determining the relative number of receivers in each of the sets therefore the ranking process must be accomplished by an examination of the construct. The author's judgment is that the information required by S should have priority for the following reasons:

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[4]She only speculated on one stock--IBM--and didn't know that she could sell short. It wouldn't be difficult to prove that she could have done better by "investing" rather than "speculating."

First, the construct of S is correct. The whole of the marginal analysis can be, and has been many times, utilized to prove the constructs presented above. It can be, and has been, utilized to prove the complete lack of relevancy of original costs to current decisions. Almost all elementary texts in economics, accounting, management, and statistics go to great pains to prove that erroneous decisions result from the use of original costs.

Second, it is the author's judgment that the use of the right information in the wrong construct would, in this situation, result in less erroneous results. That is, original costs lack any modicum of relevance and thus the decisions made on the basis of original costs can be correct only by chance. Decisions made on the basis of relevant information, even in the wrong construct, have at least an equal chance of being correct. If chance is the sole determinant of correct decisions, all information is equal. We can now conjecture that relevant information would produce some--however few--correct decisions above chance.

Third, it is likely that the relevant information would have some educational benefits. If for no other reason than that it would force the receivers to wonder what to do with the information.

Finally, it may be that C_2 contains fewer receivers than S.

This now leaves us with the set of receivers, S, who utilize the constructs specified. There are several subsets of S:

s_1 = subset of those receivers using comparison of predictions.

s_2 = subset of those receivers using a prediction of the trader's predictions.

s_3 = subset of those receivers using factual conditions.

s_4 = trader(s) or manager(s).

Since all of these utilize the constructs set forth above, if we can determine the number of receivers that need each bit of information, we can rank this information in "value." That is, the receivers are using the same construct so that the number of them is the sole determinant of the "value" of information.

We can list the problems, the binits and the receivers as follows:

PROBLEM	BINITS	RECEIVERS
A	Present transco	$s_1 \cup s_4$
	Present position	$s_1 \cup s_4$
B	Present transco	$s_2 \cup s_4$
	Present position	$s_2 \cup s_4$
	Latest transco	$s_2 \cup s_4$
	Latest position	$s_2 \cup s_4$
C	Present transco	$s_3 \cup s_4$
	Present position	$s_3 \cup s_4$
	Factual conditions	$s_3 \cup s_4$

We can reclassify these as binits and receivers.

Present Transco	$s_1 \cup s_2$	$s_3 \cup s_4$	$= s^1$
Present Position	$s_1 \cup s_2$	$s_3 \cup s_4$	$= s^1$
Latest Transco	$s_2 \cup s_4$		$= s^2$
Latest Position	$s_2 \cup s_4$		$= s^2$
Factual Conditions	$s_3 \cup s_4$		$= s^3$

It appears that $s^1 = S$, and thus contains all of the receivers in the set. It is highly probable that $s^1 \supsetneq s^2$ and $s^1 \supsetneq s^3$. For this not to be true, i.e., for $s^1 \supseteq s^2$ or $s^1 \supseteq s^3$, two very unlikely conditions would have to be met. One, that s_3 contain the same number of elements as s_4 and, two, that s_3 contain the same elements as s_4. The probability of each of these is small and the probability of both is smaller yet. Thus, we can say with little fear of contradiction, that

$$s^1 \supsetneq s^2 \quad \text{and} \quad s^1 \supsetneq s^3$$

Transitively, then, we could rank the value of the binits by numbers of receivers, as

1. Present transco and present position.
2. Latest transco, latest position and factual condition.

Note that the factual conditions contain a number of different binits that are relevant to different receivers. Therefore, each element of factual conditions is relevant to a smaller number

of receivers than s_3. That is, s_3 is the set of all receivers who need any fact, but, any particular fact is relevant to only part of that set. Thus, we can rank the binits in a finer gradation.

1. Present position, Present transco.
2. Latest position, Latest transco.
3. Particular factual conditions.

Thus, from a purely informational point of view, the present transco and present position have the highest priority in a limited channel situation. It would be natural to assume that these would be transmitted since they have the highest priority and thus (2)--Latest position and latest transco--would be prolix to any subsequent transmission. If there is any idle channel capacity, of course, the other bits--interim transco, interim position--could be transmitted but they would have a much lower order of priority.

Summary

We have set up a perfect communication system and listed all of the bits that could be transmitted in that system. We have analyzed the various receivers and ranked them in accordance with their constructs. The order of all receivers, n, follows:

1. S, those receivers with the constructs specified.
2. C_2, those receivers with an original cost construct.
3. C_1, those receivers with various other constructs.

By further classification of S we were able to rank the receivers by the numerosity of elements in each subset:

1. s^1, those receivers to which the present position and present transco are relevant.
2. s^2, those receivers to which the latest transco and latest position at the last evaluation are relevant.
3. s^3, those receivers to which particular factual conditions are relevant.

Finally we recast the above into an ordinal measure of the value of the binits.

1. Present position and transco.
2. Latest position and transco at the last evaluation.
3. Particular factual conditions.
4. Past (entry) transcos.
5. Information that does not emanate from the model.

We can eliminate (5) because it would be handled by another communication system. (2) can be eliminated by the cumulative aspect of our system. Thus, the final order of value for the informational bits is:

1. Present position and transco.
2. Particular factual conditions.
3. Past (entry) transcos.

Measurement in the Model

The informational analysis has revealed the bits that are relevant to various constructs and we have set up an order of value of those bits. It is clear that these binits must be capable of measurement--or at least capable of being determined--if they are to be communicated.

We have described the value dimension and the related concept of sacrifice above. We have also accepted money as the proper unit or valuing agent. Thus, we have gone a long way toward fulfilling the measurement proposition requirements. There are several things that still need to be made explicit, however, and that is the purpose of this section.

There is no measurement problem in determining money. We have assumed that its value is unity and that there is no problem in determining quantities. Money can simply be counted and then recorded.

The quantity of wheat, likewise by assumption, is no problem other than counting. The locus of the difficulties, if any, is in the determination of the transco.

We have already pointed out the impossibility of measuring the future. We should now make clear that what is meant by the "present" is "last perceivable instant." That is, the "present" is such a fleeting moment that any attempt to state a condition in the present is impossible; the "present" has become the past by

the time the statement is made. Hence, our concern is with the measurement of past transcos and the "present" is only a convenient way of stating "the last perceivable temporal instant." Thus, the requirement of expost conditions is met by both the past and present transcos.

The only thing left then is to specify the operation--the comparison, the unit and the use of numbers.

First, the transco is per se a comparison. It is a comparison of objects to units and the purpose is to facilitate the comparison of objects to objects. One compares the object (wheat) to the unit (dollars) and then another object (corn) to the unit and finally the units vis-a-vis units. This is precisely the way that cotton cords are compared to I-beams in the dimension of length. Note, however, that the procedure is different and this is where the confusion lies.

If one had an I-beam he could align it with meter sticks to determine the length. That is, he performs an operation (perhaps with an instrument) with a unit object. The original cause of the length or a possible future change in the length is of no concern in this operation. He is simply trying to discover the present length. If he has a number of identical I-beams,[5] he could

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[5]He may discover that they are "identical" by aligning object to object.

draw off a graph.

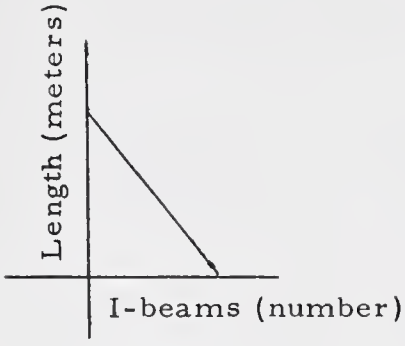

Figure 15

Precisely the same thing happens with wheat but the instrument is rather more complex. The market is the instrument that makes the comparison of object to unit to object. A person determines that he has wheat that is identical to that in the market and then "reads the instrument." He "aligns" his wheat with other identical wheat that has been, and is being, measured and then he can draw off his graph. The difference is in the complexity of the "instrument" but this shouldn't give us pause; one can prospect for uranium without understanding a Geiger counter if one can count the clicks.

Another difference is in the peculiar nature of the unit object. Dollars are used in the market as a unit interval. The unit object (currency) cannot be used to align or balance the wheat but that is not its purpose. The purpose of the unit object is a promise, a tangible indication of a claim, not the measurement of wheat. The unit interval is also rather more complex. One cannot hold up his hands and say "this many dollars" as he

can say "this many meters." This particular unit interval is a much more general one, indeed the most general unit interval at our disposal. It encompasses all other attributes, characteristics, of objects in a general expression of a degree of preciousness, desirability. Thus, the unit interval is quite complex, abstract, but neither should this give us pause. One can become an X-ray technician without a unit object for the rather abstract notion of the unit-interval of a Roengten.

The Additive Axiom

It is clear that this measurement of sacrifice fulfills the requirement of the additive axiom. In fact the raison d' être of the measurement is to express the sacrifice cardinally so that heterogenuous objects may be summed, exchanged, fractioned. One complication arises however in the temporal specification of the dimension. Many, if not most, additive dimensions are invariant as to time. The reverse is true with the measurement of sacrifice; in fact time is one of the most important variables in the measurement of sacrifice.

In one sense money can be thought of as invariant over time. If a given amount of money is held, the sacrifice is an entire array of goods which produce utility. Under a stable price level this amount of money would produce the same utility at all times. However, if we compare the amount of money to any particular good, instead of utility, it is not invariant. The

present quantity of money then is not a temporally invariant sacrifice for utility but it is the present sacrifice for any particular good. Money in relation to a good is always a present sacrifice.

The sacrifice of wheat is not invariant over time, even to utility, unless the transco is constant. Quite the contrary, the change in the transco, if wheat is held, means the change in the sacrifice of money and hence of utility and other goods.

This means that we can multiply a past quantity of wheat by a past transco and add it to a past quantity of money and then speak meaningfully of the past sacrifice of both utility and goods.[6] We can do the same with present transcos and present quantities and speak meaningfully of the present sacrifice. The sacrifice is additive intertemporally also. We could subtract the past from the present sacrifice and determine the increment.

However, it should be obvious that if we mix the temporal location of the quantities and transcos then they are not additive either instantaneously or intertemporally.

A physical analogy may be helpful. Assume a forest ranger with a varying quantity of trees, Q, and an identical amount of board feet per tree, F, but with F varying over time. He can calculate his total board feet at t_1 as

$$X(t_1) = Q(t_1) \cdot F(t_1) \qquad \text{(eq. 1)}$$

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[6]If the transcos of other goods in the same temporal location are known.

and at t_2

$$X(t_2) = Q(t_2) \cdot F(t_2) \qquad \text{(eq. 2)}$$

But if he mixes the temporal location we have a little explanation.

$$X^1 = Q(t_1) \cdot F(t_2) \qquad \text{(eq. 3)}$$

X^1 can be read as:

> "Total board feet that I would have if I still had the same number of trees that I had at t_1 and if all those trees had grown equal to $F(t_2)$."

This is a counter-factual conditional; a statement in the subjunctive mood. It may be perfectly valid information and relevant to some problems but it has nothing to do with the discovery of an extant dimension--measurement--and little if anything to do with the selection of alternatives.

Now suppose the ranger has at the present another total quantity of board feet, X^2, say, in another location or in another form.

$$X^3 = X^1 + X^2 \qquad \text{(eq. 4)}$$

X^3 is a present extant quantity added to a hypothetical quantity which makes the entire statement hypothetical. X^3 says nothing about the past, present or future expected quantity. Its use, if any, is limited to the analysis of hypothetical alternatives.

Measurement is concerned with the <u>discovery</u> of units in a dimension, not with the hypothesizing about what might be. To add a measurement to a hypothetical quantity and then call the

sum a measurement is a travesty of the term. In addition, if X^3 is presented as a measurement of a quantity the information is not only irrelevant, it is not veritable.

The conclusion is clear: a mixture of temporal locations is neither measurement nor veritable information.

The point is elementary but unfortunately the error is often made. Most messages of valuation are derived from a past transformation coefficient multiplied by a present quantity. The result is inevitably a hypothetical situation[7] if measurement of sacrifice is the purpose. The usual situation is that only the product and the date of multiplication is presented as a measurement and/or information. In this situation one cannot even guess at the hypothetical conditions much less at the actual expost quantity.

Suppose one were given X^1 at t_1 and X^2 at t_2. Assume further that we know that $Q(t_1)$ and $Q(t_2)$ were used to calculate X^1 and X^2 respectively but we have no further information. Now X^1 or X^2 alone is a very interesting statistic. It can be read as

> "This is the total board feet that I would have
> if I had the quantity (unspecified) of trees that
> I now have and if the board feet per tree

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[7]The particular hypothetical situation is described as a "static economy assumption" by Edwards and Bell. They prove that only under the conditions of a static economy--in this case the relevant static would be the transco--is such a message valid or useful. We prove the same from a different approach below.

(unspecified) was the same as it had been at

a time (unspecified) in the past."

The interesting thing about this statistic is that it is very likely to have negative informational content. At best it is useless, irrelevant, and at worst it is misleading if anyone attempted to use it.

It may be, and sometimes is, argued that the direction of movement of such a statistic is meaningful even if the isolated statistic is not. We can calculate the difference

$$X^2 - X^1 = d$$

Assuming d to be positive, what can be said about it? Since both X^1 and X^2 are hypothetical the most that can be said of d is that it is a difference between hypothetical (unspecified) conditions. We cannot infer anything about the relative size of $X(t_2)$ to $X(t_1)$ or $Q(t_1)$ to $Q(t_2)$ or $F(t_1)$ to $F(t_2)$. The difference could be caused by any one of the following changes:

1. An increase in Q and decrease in F.
2. An increase in Q and increase in F.
3. An increase in Q and constant F.
4. A decrease in Q and increase in F.
5. A constant Q and increase in F.

The magnitude of any of the increases and decreases could be any one of an infinite series of numbers and the temporal location of F could be any one of an infinite number of instants. Without

fear of overstatement one can say that the results are imprecise. The mind boggles at imagining a possible use for such "information."

The above has been concerned with the intertemporal comparison of board feet. If we have a second ranger and want to make an instantaneous comparison, the mixture of temporal locations results in even more confusion. It is clear that if they both measure at the same time the results are subject to the additive axiom. Even if they measure at different times the results may be adjusted so that they are additive.[8] However, if the temporal location of the multiplier and multiplicand are mixed and only the product of both equations are given the results are completely without meaning.

This can be stated in general terms. Suppose for example that we have two objects that are identical in all respects. (We intuit that they are identical.) Thus,

$$Y_1 \equiv Y_2$$

Utilizing Caw's statement that a measurement can be stated as:[9]

2 (length in meters) this rod

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[8]Of course the specification of the temporal location is essential to the adjustment. In fact one would not know that an adjustment is needed unless he knew that there was a variation in temporal locations.

[9]Peter Caws, "Definition and Measurement in Physics," Measurement: Definitions and Theories, eds., C. West Churchman & P. Ratoosh (New York: John Wiley & Sons, Inc., 1959), p. 4.

We can measure these objects at the same time and place and then express the relation as follows: (U_1 and U_2 are units.)

$$U_1 Y_1 = V_1$$

$$U_2 Y_2 = V_2$$

if

$$U_1 \asymp U_2$$

then

$$V_1 \asymp V_2$$

and we have a contradiction of the worst order. The sine qua non of measurement--comparisons--has been abrogated. One cannot relate, order Y_1 to Y_2 on the basis of V_1 to V_2 intensively, much less extensively, because of the contradiction. How does one interpret the difference between V_1 and V_2? What does it mean? The only possible interpretation is that it is an error and if a metrician continued to make the error deliberately one would be tempted to impugn his motives.

This rather lengthy analogy is perfectly applicable to the trader's situation. All of this may be concisely stated:

> Measurements that are invariant as to time conform to the additive axiom only if the temporal locations are homogeneous.

The temporal locations of the transcos and quantities that were selected above are homogeneous. The conclusion is obvious.

Problems of Observation and Instrumentation

As noted above the present is simply a convenient method

of expressing the most recent past. Thus, all of our measurements are in the past and there is no reason to assume that there is more or less difficulty in observing any particular past instant. In fact, it could be argued a priori that if all past instants are identical there is good reason to believe that all are equally difficult or easy in observation. We have assumed a perfect market in our model so the problems of observation have been simplified.

Nevertheless there are a great many people who argue that the problems of observation are so great that some critical act must occur before the measurement can be made. One of the most extreme examples of this was reported recently. An accountant reported (measured?) Canadian dollars at a previous (entry transco) foreign exchange rate.[10] They were then added to American dollars. Presumably the reason for this was because of the difficulty of observing the exchange rate until the exchange was complete. One would think that foreign exchange

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[10]On the other hand, perhaps the most extreme adherence to accounting for the historical costs of current assets was recently described by Professor Dixon of the University of Michigan. He discovered an accountant who insisted on disclosing Canadian dollars at par rather than at the current exchange rate of approximately 92 cents. It seems the Canadian dollars were originally acquired dollar for dollar and the accountant was determined to reflect cash at its historical cost.
Related by Professor Robert L. Dixon, Graduate School of Business Administration, University of Michigan at American Accounting Association Round Table, East Lansing, Michigan, August 29, 1962.
Robert T. Sprouse, "Historical Costs and Current Assets," Accounting Review, XXXVIII, No. 4 (October 1963), p. 687.

rates were identical to similarity transformations of say, meters to feet except for their time invariance. Although this case is extreme there are many others in which the general rule is not to report entry transcos until the exchange is complete.[11]

For purposes of discussion, we will grant that certain conditions may make observations more difficult. For example, it is easier to determine the spatial location of a body at rest than a body in motion. Thus, Aristotle could contemplate a falling stone and come up with a measurement of speed with only the simplest of instruments. We now know, by use of better instruments, that he was measuring average speed; that the stone accelerates. Aristotle's measurement may be visualized as

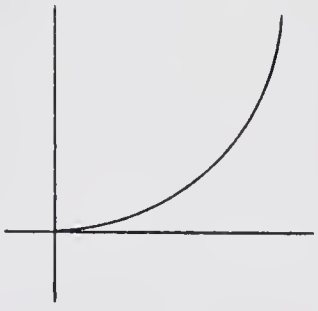
T_1 ----------T_2

D_1 ----------D_2

and the speed as the quotient

$$\frac{D_2 - D_1}{T_2 - T_2} = S$$

A more sophisticated view of speed is shown as follows:



[11]There are several other reasons for following this procedure which will be discussed below.

Because of the lack of instruments Aristotle was forced to wait until the "critical act" of the stone coming to rest occurred before he could measure its spatial location. He could not have measured the distance at say, t_3 but surely he would not report that the spatial location at t_3 was D_1. He might have said that the location at t_3 was "undetermined," even "undeterminable" or simply "in motion" but certainly not D_1.

If he needed to know the spatial location at t_3--if this was relevant information--he would be forced to estimate, guess its location. It's very likely that there would be a considerable lack of inter-observer agreement in such an estimation and this is a serious short-coming. However, if any observer reported D_1 we would certainly question his perception and perhaps his integrity and sanity. Also, we might hesitate to term such an estimation a measurement but it is at least as much of a measurement as the reporting of D_1.

This example is useful because it casts the problem in clear relief.

1. The distance travelled at t_3 is relevant. We need to make a decision based on the D at t_3. If that is undeterminable the decision cannot be made in accordance with the construct.
2. D_1 is irrelevant and is not a measurement. Further, it is highly probable that we could

get unanimous inter-observer agreement that it was not D_1 at t_3.

3. An estimation of the distance at t_3 is superior to the complete absence of information. However, estimations suffer from lack of precision and inter-observer agreement.
4. A measurement of the distance at t_3 is the desideratum. The reason is because it would be more precise and there would be more inter-observer agreement; we would have more confidence in the data.
5. Sophisticated instruments and observers are required to make a measurement at t_3. There are two extreme alternatives, (1) we can bewail the lack of instruments and observers and continue to report D_1 or (2) we can try to develop the instruments and observers and utilize the estimation in the interim.

The same is true of difficulties in the measurement of transcos. If it is true that a transco is difficult to determine in the absence of an exchange, then we can all lament the fact but this does not give us license to report irrelevancies simply because they are easier to determine. The problem is in our observations and instrumentation. It would appear then that the

obligation of a metrician is to seek ways to improve his instruments and observations.

In the model we deny that the present transco is more difficult to measure than past transcos. However, in anticipation of the criticism that this is true only because of the perfect market, it should be pointed out that any measurement benefits derived from a perfect market are equally applicable to all transcos. Specifically, the perfect market assumption makes the present transco easier to determine but it also makes the past (entry) transcos easier because it avoids all incidental and ancillary costs of purchasing and selling. In fact, it can be argued that the present transco is much easier to determine than the entry transco in an imperfect market. That is, in a perfect market the difficulties are equal but in an imperfect market the present transco is easier to determine.

Summary

We have reviewed the present transco in light of measurement theory and found that it was amenable to measurement. Even the "narrow" metricians would accept the present transco as a measurement because it is subject to the additive axiom. Other proposals and practices were examined and found to be hypothetical conditionals that could not properly be termed measurements and certainly were not additive.

Any difficulties that arise in the measurement of present

transcos are those of observation and instrumentation. We deny that, in a perfect market, such difficulties are greater for a present transco than for a past. Even if they were, however, an estimation of the present transco is far superior to deliberate error of reporting a past transco as a measurement of the present state.

SUMMARY OF PART ONE

In this section we have restricted the discussion to a simplified model of trading in a perfect market. The problem of income determination--under the well-known definitions of income--becomes one of measuring wealth at a point in time. There are four proposals for such a measurement, viz., The Fisher Tradition, The Accounting Tradition, Boulding's Constant, and Present Market.

We selected cash as the proper valuing agent and noted that this reduced the problem to the determination of value under the conditions of an incomplete exchange. A consideration of the timing of the valuation led us to the conclusion that the impetus of the problem was a desire for information at a specified time.

A review of information and measurement theory allowed us to set up some generalized criteria for the selection of the valuation coefficient. An important requirement was the description of the dimension and specification of the problem and

the construct. The construct then allowed us to specify the information relevant to the various problems.

A listing of all of the binits emanating from the model and an assumed communication system in relief against the relevant binits permitted the ordinal measurement of the value of the binits. Certain binits were eliminated because they were exogeneous to the model or because they were prolix. This left us with

1. The present transco and position.
2. Factual Conditions.

in that order as the only relevant bits to be communicated.

An examination of these binits in light of measurement theory found them acceptable even to the narrow metricians as proper measurements.

Thus, our conclusion is that the present transco is the proper and correct valuation coefficient for the measurement of wealth at a point in time. Other transcos are irrelevant and/or are not measurements. Income then is the difference between the sums of the quantity of money and the quantity of the trading asset times the present transco at two points in time, the time being determined by the desire for information.

Part one of this study has been concerned with the selection of the correct valuation coefficient from an information--measurement viewpoint. This concludes part one. Part two will be a more traditional analysis of the alternative valuation coefficients.

PART II

In Part One we concentrated on selecting a valuation coefficient utilizing information-measurement criteria. In this part we will take a different tack. Our purpose will be to subject each of the proposed valuation coefficients to a rather close scrutiny. We will criticize the various proposals from the vantage of our general information-measurement framework and in addition from the more traditional economic viewpoint. The intent is to reject the proposals that are unable to tolerate close observation. Both Part One and Part Two have the same goal--the selection of a valuation coefficient--but the procedure varies. Part One has dealt with selection from alternative proposals; Part Two deals with selection by elimination.

After the selection has been made we will relax the perfect market and stable price level assumptions. We will examine the problems created by a unit that is not temporally invariant, criticize in a general way the proposals that have been advanced toward the solution of that problem, and make some recommendations.

CHAPTER VII

BOULDING'S CONSTANT

Professor Boulding's analysis is a masterful one. His model is useful in illuminating several other economic problems in addition to income measurement; his perspicacity and felicitous style allow him to strip away the frivolous and immediately to incise the problem. However, his analysis of the nature and determination of income is imperfect. He states the problem succinctly and, we think, correctly and appears to be headed toward an unassailable conclusion, only at the last moment to veer off and sometimes vacillate, sometimes err.

Because of his vacillation, it is difficult to present a critique. Some of his statement may be described as misplaced conclusions, most of which are correct, but other statements, which we take to be the final conclusions, are demonstrably wrong. Thus, there is some danger in criticizing him: the danger of misunderstanding what his conclusions are and demolishing only a straw man. We will flirt with this danger by taking what we think are Boulding's intended conclusions and discussing them. We will not attempt to list all of his inconsistencies and use them *per se* as criticism nor will we attempt to reconcile them. It should

be clear, however, that our quarrel finally concerns the brief analysis of income presented in Reconstruction,[1] and not all of his writings.

Boulding's conclusion in its most straightforward form is as follows:

> All valuation thus seems to possess a certain unavoidable arbitrary element, as long as the asset structure remains heterogeneous.[2]

The word "all" plus the fact that this statement was made after he suggested the constant indicates that the constant is also arbitrary. In another context, when he does not suggest the constant, he writes:

> It must not be thought that the valuation of the "things" possessed by a society is a simple, easy, or even certain process. There are many undoubtedly valuable things that are not ordinarily valued at all.[3]

Then under the heading "All Valuations a Matter of Estimate" he continues:

> The difficulties of valuation, however, extend far beyond the case of things which are not usually valued. Even those values which normally figure on balance sheets are calculated by a process of estimate

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[1]Kenneth E. Boulding, A Reconstruction of Economics (New York: John Wiley & Sons, Inc., 1950).

[2]Ibid., p. 45.

[3]Kenneth E. Boulding, Economic Analysis, 3rd. ed. (New York: Harper & Bros., 1955), p. 263.

> according to certain rather arbitrary principles.[4]

When quarrelling with the profit maximization notion he complains:

> The main difficulty is that the quantity which is supposed to be maximized does not exist! It would be unkind to call it a figment of the accountant's imagination but it is certainly a product of the accountant's rituals.[5]

Presumably the reason for describing these actions as rituals is because they are rites, ceremony over which the accountant has considerable discretion, i.e., they are arbitrary. In another context he defends these rituals:

> Ritual is always the proper response when a man has to give an answer to a question, the answer to which he cannot really know. Ritual under these circumstances has two functions. It is comforting (and in the face of the great uncertainties of the future, comfort is not to be despised) and it is also an answer sufficient for action.[6]

There are two points here. One, valuation is concerned with the future and the future is unknown and two, rituals produce relevant information (answers sufficient for action). Respectively and respectfully we agree and disagree vigorously and wholeheartedly.

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[4]Ibid., p. 263.

[5]Kenneth E. Boulding, The Skills of the Economists (Cleveland: Howard Allen, Inc., 1958), p. 28.

[6]Kenneth E. Boulding, "Economics and Accounting: The Uncongenial Twins," Studies in Accounting Theory, eds., W. T. Baxter and S. Davidson (Homewood, Ill.: Richard D. Irwin, Inc., 1962), p. 53, second emphasis supplied.

Much of Part One of this study was an attempt to prove the validity and invalidity of these points. Boulding continues:

> It is the sufficient answer rather than the right answer which the accountant really seeks. Under these circumstances, however, it is important that we should know what the accountant's answer means, which means that we should know what procedure he has employed. The wise businessman will not believe his accountant although he takes what his accountant tells him as important evidence. The quality of that evidence, however, depends in considerable degree on the simplicity of the procedures and the awareness which we have of them.[7]

Two points emerge here also. One, the operation proposition--that the description of the instrument, procedure makes the measurement useful, relevant--and two, that simplicity of procedure produces quality. The first point is common to a goodly number of people from a variety of disciplines.[8] However, as we pointed out above, it will not stand an informational criterion. Hempel's hage example demolishes it. The second point stands or falls on the first. Of course, the procedure should not be unnecessarily complex, but the criterion of necessity depends upon the goal. No one would deny the proposition that the procedure should be no

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[7]Ibid., pp. 53-54.

[8]For example from physics P. W. Bridgeman in The Logic of Modern Physics (New York: Macmillan Co., 1927) argues that a non-operationally defined construct is "a platonic view of the world diametrically opposed to the whole operational approach." His book is in large part an attempt to prove the primacy of operations. Cf. Caws in Churchman, Measurement: Definitions and Theories. The quote is from Caws.

more complex than is necessary to furnish the relevant information. However, this statement is truistic and barren of genuine content. Juxtaposition of a meter stick is a very simple procedure but it hardly produces quality in measuring planetary distances. A cyclotron entails a very complex procedure but it does not inhibit quality in the measurement of the velocity of deuterons. Quality is an ambiguous term in this context. If it means precision, it is easy to demonstrate that complexity usually varies directly with precision. It is difficult to see how veritableness would have a relation to simplicity of procedure. Relevance is specified by the construct, not the operation. In short, the relation between "quality" and simplicity of procedure escapes us. We agree that simplicity is a desideratum but it has a very low priority relative to the criteria listed above.

Boulding, however, is so convinced of these points that he is "suspicious of many current efforts to reform accounting in the direction of making it more 'accurate'."[9] This suspicion does not follow from the operational viewpoint--operationalists are continually seeking improvements in accuracy--instead it is the restatement of his unwavering belief that all valuations are arbitrary.

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[9]Boulding, "Twins," p. 54.

With such a belief as a starting point it is not difficult to understand how he reaches his conclusion. All valuations are arbitrary; a constant is no more arbitrary than other valcos; a constant is simple; therefore, a constant is the proper valco. Our basic disagreement is with his belief that all valcos are arbitrary. The superficial disagreement is with his proposal that a constant is the proper valco.

Our dictionary defines "arbitrary" as:

> Arising from unrestrained exercise of the will, caprice or personal preference...based on random or convenient selection or choice rather than on reason or nature...[10]

In short, arbitrary implies that there is no rational method of selection. Obviously we disagree. This entire study is an attempt to make a selection based on rational criteria. We set forth our criteria in Part One and thus, if one is willing to call our criteria "rational," the selection is not arbitrary. Boulding gives every indication that he would accept our criteria, if not our analysis. He shows great respect for "information," noting that it is perhaps the chief contribution of operations research.[11] In another context he echoes the complaint of this study:

> My plea for naivete, or at least for simplicity in accounting practice, does not preclude the

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[10]Webster's Third New International Dictionary, unabridged, ed., P. Babcock Gove (Springfield, Mass.: Merriam Co., 1961), p. 110.

[11]Kenneth E. Boulding, "Contemporary Economic Research," Trends in Social Science, ed., Donald P. Ray (New York: Philosophical Library, Inc., 1961), p. 11.

> hope that one day we may be able to set the whole information-collecting and processing operation of an organization on a somewhat more rational basis than now exists. At present one suspects that a great deal of information is collected and processed which actually is irrelevant to the making of decisions or the taking of any kind of action. The collection of such information is pure waste from the point of view of the organization though it may have certain scientific value.[12]

And finally he succinctly sets forth the criteria:

> Nobody, to my mind, has yet developed an adequate theory of information collection and processing from the point of view of the decision-making process.[13]

Such a development, in a very narrow context, is the central purpose of this study. Thus, it seems eminently reasonable to assume that if Boulding accepted our analysis he would abandon his "arbitrary selection" position and there would be no fundamental disagreement.

In fact on one occasion he implies that profit is measurable under perfect market conditions. He writes:

> This is to say that the theory of profit maximization is only applicable to the case in which all markets are perfect, where there is no difficulty in transforming any asset into any other, and where the form of the asset structure is unimportant.[14]

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[12]Boulding, "Twins," p. 55.

[13]Ibid.

[14]Boulding, Skills, p. 49.

Since he previously complains about the lack of existence of the maximand and uses this as a reason for arguing against the notion of profit maximization, but then states here that profit maximization is applicable to perfect markets, we may conclude that he thinks that the maximand does exist in perfect markets. Nevertheless, in Reconstruction he uses a perfect-market model and concludes that this extant maximand--profit--is arbitrarily determined. Because of this inconsistency, it is not clear how we stand in relation to Boulding. On the one hand there appears to be complete agreement, especially in view of our perfect market assumption, but on the other hand his perfect market analysis conclusions are diametrically opposed to ours. For this reason we feel obliged to discuss the analysis that leads to the conclusion of a constant. The conclusion and analysis is presented in Reconstruction and the following is from that source.

First, Boulding's fear that a particular valco would indicate that profit comes about only from a price change is fallacious. It is clear that both a price change and an exchange are necessary for income. The trader must put himself in the position to profit from the price change; if he holds the riskless asset--money--without exchanging, it is clear that he can never increase his stock. Yet he can exchange all he wants in a constant price market and never profit. There are two variables to the income process:

1. Position--which is achieved only by exchange.

2. Price change.

Both are prerequisites to income. Income cannot be garnered without both variables being present. It is nonsense to say that either one is more important than the other.

Of course Boulding does not say this but what he does say is that the selection of a particular valco necessitates the proposition that income arises solely from one variable. The complete quote is:

> If we follow the rule of equating the valuation coefficient with the transformation coefficient, i.e., if we value our wheat stocks at the market price of wheat, we run into several difficulties. This assumption, as we have seen, necessitates the proposition that no values are created and no profits made in the pure act of exchange, but that profits and losses come only when stocks are revalued because of a change in price.[15]

We agree with the first part of the proposition--that no profits arise from the pure act of exchange--but we fail to see how any of the proposition follows from the selection of the valco.

Both are necessary, indispensable, prerequisites to income and thus we would never recognize income on one alone. However, when both are present we see no reason not to recognize income. Boulding's problem seems to be in imputing causality to the temporal location of a variable. The temporal order

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[15]Boulding, Reconstruction, p. 43.

of the prerequisites is, first, position and, second, price change. One cannot obtain the position after the price change because that alternative no longer exists and thus the temporal order is specified by the process.

The same is true in many physical processes. For example, one must plant (position) a tree first and then it must rain. If it rains without planting there is no growth and vice versa. If it rains first and then the tree is planted there is no growth without further rain. The alternative of planting before the rain is no longer available. Thus, the analogy contains the essential elements.

1. Two variables, both prerequisites.
2. Temporal order specified by the process.
3. Non-recurring opportunities.

If we measured the growth of the trees after the rain no one would suggest that the rain was the sole cause of the growth. By the same token, there is no reason to impute single causality to a price change simply because the measurement is made after the change occurs. The proposition does not follow. In fact one could push the analogy further by assuming that the volume of growth was equal to the volume of water. Under this assumption, one can determine the growth by measuring the rain as it occurs without necessitating any propositions about "pure act of planting" or "pure act of raining." The growth is the conjunction of two

variables, temporally ordered, and the last variable indicates nothing about causality even if it is used as a measuring rod.

There is one important distinction between the variables however. The trader (planter) has control over his position but no control over the price change (rain). Clearly though the endogenous or exogenous nature of the variable has little if anything to do with measurement or valuation and nothing to do with causality.

Boulding slips at another point by vacillating on the valuing agent. He points out that the net worth could be stated in either money or wheat and then:

> A "rise" in the dollar value, or "price," of wheat is the same thing as a fall in the wheat value of dollars; it is reflected in a shift of the valuation line from, say, VmVw to Vm^1Vw^1. This results in a rise in the net worth measured in dollars, and a fall in the net worth measured in bushels. We shall see later that this apparent paradox leads to some serious difficulties in the interpretation of accounting procedures.[16]

There is no paradox, either apparent or real. It simply is the result of shifting valuing agents--measuring units--and it should not come as a surprise that the results of using different units are different magnitudes. Surely no one would be surprised if a measurement of an object in feet was different from the measurement in inches or pounds.

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[16]Ibid., p. 41.

This unfortunately is all too common an error. Many writers argue about whether one should "keep physical capital intact" or "keep money capital intact." Then they get confused by this "apparent paradox." For example, assume the following facts:

> $100 cash upon entering the market.
>
> Purchase of 100 bushels of wheat at $1.00 per bushel.
>
> Sold 100 bushels at $2.00 per bushel.
>
> The present transco--replacement price-- is $2.00 per bushel.

The argument then runs that, if viewed from "keeping money capital intact" we have made $100 but if we view it from "keeping physical capital intact" we are no better off than before. That is, we started with 100 bushels and if we now replaced this physical capital we could only get 100 bushels, ergo, there is no income.

This argument is valid if wheat is used as the valuing agent. One can interchange the words "wheat" and "money" in the assumed facts and using money as a valuing agent conclude that there was no income. Assume the facts to be as follows:

> 100 bushels upon entering the market.
>
> Purchase of 100 dollars at 1 bushel per dollar.
>
> Sold 100 dollars at 2 bushels per dollar.
>
> The present transco--replacement price--is 2 bushels per dollar.

The trader started with 100 bushels, ended with 200 and thus

there is a 100 bushel income. However, there is no change in the amount of money available to him and thus a zero dollar income.

Both statements are valid. The problem is simply one of valuing agent selection and consistent use of that valuing agent. We selected money as the appropriate valuing agent above and gave our reasons for doing so.

There is one further point in the apparent paradox. Boulding's statement is true only for a special case and the specification of the conditions of that case further clarify the paradox. If the trader holds all wheat--the position is the intercept of the X-axis--the rise in price does not result in a fall in the net worth measured in bushels. The net worth in bushels remains constant. If the trader holds all money the rise in price does not affect his money net worth but it does decrease his bushel net worth. Thus, Boulding's paradox of opposite movements in net worth occurs only when the trader's position is somewhere between the two axes--when he holds <u>both</u> commodities. However, a moment's reflection of the two extreme cases will dispel the paradox. The decrease in bushel net worth, under conditions of holding money when prices are rising, is a direct measurement of the opportunity of gaining that the trader has lost. The trader was in the wrong position for a price increase and he lost an opportunity to gain. This opportunity to gain may be measured by calculating the increase in money net worth if he had been in the right

position or by valuing the decrease in bushel net worth by the present transco. When all money is held there is no question that a rise in price results in an opportunity loss from being in the wrong position. When the trader is between the axes the paradox is the result of the same phenomena. The trader holds a portion of his assets in money and the rise in prices results in an opportunity loss for that portion. There are degrees of wrongness in position and the trader will always suffer some opportunity loss when he is in the wrong position.

Essentially the same type of error is made when he speaks of "apparent losses."

> The revaluation (fall in price) at the beginning of the next day lowers the net worth, however, to OM_2; there is an apparent loss of $M_1 M_2$. Nevertheless it is upon the foundation of this apparent loss that subsequent profits are made, for if it were not for the changes in price the net worth could never be increased through exchange: moving to P_3, to be able to take advantage of the subsequent rise in price brings the net worth on the fourth day to M_3.[17]

The apparent loss is indeed a real loss because the trader failed to take advantage of his opportunity to change his position. The trader held wheat and the price fell. That is a real loss because the trader was in the wrong position--making the wrong prediction--when the price changed and no future price change will

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[17] Ibid., p. 45.

obviate that loss. If the trader had exchanged at the higher price before the price fell, he would clearly have a larger amount of net worth.

The error in the analysis seems to be in Boulding's assumption about the pattern of the price changes. The next line reads

> So the process goes on, with an apparent alternation of losses and profits, decreases and increases in net worth, even though the general process is clearly a profit-making one.[18]

The process is profit making only after-the-fact. Ex ante it could just as clearly be a loss-making one. It could be that "it is upon the foundation of this apparent loss that subsequent losses are made." Boulding has assumed a pattern of price changes and positions which yields a final profit. Then he has taken a point in the middle of this pattern and said that this is only an "apparent loss" because the final outcome is profit. If, however, we do not know what the final outcome will be, i.e., if we are measuring at the instant of the fall in price, then the general process is uncertain and the foundation may be for either profits or losses. Facing such a situation there is no reason to modify loss with "apparent" and there is good reason to exclude the modifier since the final outcome could make the loss "real."

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[18] Ibid.

Both the "apparent paradox" and the "apparent loss" are products of uncertainty. Both would disappear if the future were certain.

Under certainty the trader would always be at the intercept of one of the axes. He would never hold both wheat and cash at the same time because he would know the direction of the next price movement and would be unwilling to suffer the opportunity loss of holding cash when the price is going to rise. Thus, his position would be perfect.

However, since the trader does in fact continually face uncertainty he is subject to both the paradox and the loss. A metrician facing the same uncertainty would not be troubled because he would not shift units and he would eschew predictions. If he called the loss "apparent" he would be predicting an uncertain future instead of measuring an ex post condition.

There is however one important difference between the paradox and the loss. The paradox is the result of the lack of one of the variables and hence we called it an "opportunity loss." The trader held a portion of his assets in cash when the price rose. For that portion of his assets the position variable was absent and hence it was impossible for him to either gain or lose. That portion of his assets was riskless. The reverse is true for the "apparent loss." He held his assets in wheat and thus had a chance for either a gain or loss. The position variable was

present and then when the price change occurred both variables were present.

This is an important distinction because it is often argued that both are counterfactual conditionals; that both are equally hypothetical.[19] The argument, stripped of the trivia, runs along the following lines:

Assume:

Condition A: Cash is held and the price of wheat rises.

Condition B: Wheat is held and the price of wheat declines.

The statements can take the following form:

A. If I had held wheat, I would have gained.

B. If I had held cash, I would not have lost.

It may be argued that the word "lost" in B grants the point so let us restate them in more general form.

A. If I had been in position X, my net worth would be Y.

B. If I had been in position W, my net worth would be Z.

The antecedents of both are false, the second clause of both is a

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[19]Boulding does not make the argument and the author suspects he would not. However, the word "apparent" suggests a hypothetical situation and the distinction is important.

retrodiction and the statements as they stand are perfectly identical. Thus, the argument seems credible. Upon closer inspection however the difference becomes clear.

Statement A, to be complete, requires an additional clause. It runs:

A. i. If I had been in position X at t_1
ii. and then the price had risen,
iii. my net worth would be Y.

i. is false; he was not in position X at t_1. ii. is an empirical question concerning the past which is, in this case, true.

Statement B requires no such clause.

B. i. If I had been in position W (if I had accepted an available alternative),
ii. my net worth would be Z (regardless of the events which later occurred).

i. is false; he did not accept his available alternative. The existence of that alternative is an empirical question, which, in this case, is true.

The distinction is now clear:

1. Statement A requires two conditions; statement B requires only one for the retrodiction to be true.
2. Statement A requires a temporal order of the conditions;

statement B has no such order.

3. Statement A is applicable to the entire universe; statement B to a specific alternative.

4. Statement A refers to a hypothetical value; statement B to the form of extant value.

To reduce it to the absurd, suppose we said

"If I had bought Manhattan Island in 1775, I would be a billionaire."

to which someone is likely to reply

"If wishes were horses, beggars would ride."

But if we said

"If I had sold Manhattan Island (implying that we had the alternative) last week, I would now have a billion one dollar bills."

The only quarrel that could arise about the latter statement is an empirical one; there may be some lack of inter-observer agreement about the selling price. Surely, however, no one would deny that these two statements are significantly different.

The reason for this rather long digression has been simply to point up the difference between hypothetical situations. To show that some situations are "more hypothetical" than others--that some are closer to reality than others. Some opponents of this view argue that all hypotheticals--counterfactuals--are essentially the same. Moreover, they utilize what Sidney Hook calls the "slippery slope" argument; that once one accepts any

hypothetical then all are acceptable and we are doomed to slide all the way down. As Hook points out in other contexts, and as we have demonstrated here, this is simply not true. There is a meaningful distinction between types of foregone alternatives. There is a vital difference between a "loss" occasioned by failure to risk and the loss caused by risking. The former we have called an "opportunity loss" and the latter a "loss" sans modifier.

Measurement by a Constant

The use of a constant suggests that there is a "similarity transformation," of bushels to dollars. There is such a similarity transformation of miles to yards, meters to feet, pounds to grams, etc. One can measure an object in one unit and transform it to another by multiplying by a constant. We have a similar situation here. One can measure the wheat in, say, bushels, and then it is suggested, transform it into dollars by multiplying by a constant. Note, however, that the prerequisite for this process is that the units be invariant; that there exists an unchanging ratio between the units. If this is not true then no similarity transformation can be performed.

The question of invariance between units is one of definition and experimentation. There exists a definition of a "foot" and "yard" and one can, by experimentation, discover the constant that will transform one into the other. The invariance of this constant is suggested by the fact that we often define one by

the other. Thus,

3 feet = 1 yard

is both a "definition" and "similarity transformation."
The statement

20 yards = 3(20 feet)

indicates the number 3 is the (constant) similarity transformation of feet to yards. In pounds to grams it is 453.6, etc. However, there exists no such constant to transform, say, pounds to feet. In the statement

40 feet = X pounds

X can be discovered only by a separate measurement. Certainly X would be different for I-beams and cotton cord. The search for a general constant that would allow one to transform feet to pounds is futile.

Precisely the same is true for the search for a constant to transform bushels to dollars. There is no ratio that is invariant; in fact, the raison d'être of the measurement is to find the magnitude of the variation. Thus, a search for a constant is not only futile but it also violates the purpose of the measurement. Moreover, if such a constant could be discovered, the transformation process is not a measurement. The measurement would occur in the determination of the quantity of bushels and the multiplication by the constant would be a restatement of the magnitude in different units, not an independent measurement.

Boulding is searching for a constant that shows a continued growth in net worth; one that avoids the "apparent alternation of losses and profits." The full quote is:

> A possible method of escape from this dilemma is to perform all valuations at a constant valuation ratio, independent of the market price. This is shown in Figure 19, P_0, P_1, P_2, P_3, are successive positions of the balance sheet. If now the valuation of wheat is performed always at a constant valuation coefficient ("price") equal to the slope of the parallel lines P_0M_0, P_1M_1, P_2M_2, etc., the net worth will rise continually through OM_0, OM_1, OM_2, etc. Unfortunately, however, the mere procedure of valuation at a constant valuation coefficient is not sufficient to insure a steady rise in net worth. Thus we see that if a smaller valuation coefficient is selected, equal to the slope of the parallel lines P_0N_0, P_1N_1, P_2N_2, etc., the net worth again exhibits a back-and-forth movement, ON_0, ON_1, ON_2, etc. There is clearly a range of constant valuation coefficients within which the net worth grows steadily without any ups and downs, and there seems to be no particular principle by which we can select any one of these valuation coefficients within the range as better than any other. All valuation thus seems to possess a certain unavoidable arbitrary element, as long as the asset structure remains heterogeneous. Only in processes which begin and end with a homogeneous quantity of some single asset, e.g., money, can the amount of profit be measured unequivocally.[20]

Faced with uncertainty at any of the intermediate points there is no good reason to find a constant that will allow net worth to increase without ups and downs. If we do not know the final outcome (and we will never know the final outcome until the

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[20]Boulding, Reconstruction, p. 45.

trader leaves the market) there is an equally good--or bad--reason to search for a constant that shows a continual decrease.

Since Boulding states that the general process is clearly a profit making one, we may interpret his constant as an ex post valuation of past positions. That is, he knows that the difference between the first and last position yields a profit so he wants all intermediate positions to also yield a profit. Thus, the valuation of past "intermediate" positions is at a kind of average between the first and last position. If this interpretation is taken, there are three points that may be raised.

One, how does Boulding know that the difference between the first and last position yields a profit? Obviously he must value the first and last position in order to know this. How does he value the first and last position? If he does it at a constant he is thereby insuring that the general process is clearly a profit-making one (as long as the quantities are greater) and then, of course, the "average" is determined. It seems to the author that the way Boulding "knows" there is a profit is to tacitly use the present transco to value the first and last position. Whether or not this is the case, our second point is--why average? We noted in Part One that a possible reason for averaging was the check on the trader's predictions. But this could not be the case here since the trader is predicting a transco and the constant has nothing to do with transcos.

If one wants an average of intermediate points we might note Boulding's plea for simplicity and suggest that either of the following are simpler than the suggested constant.

1. Average increase in transco per exchange or per time period.
2. Average increase in net worth per exchange or per time period.

In summary, we can find no reason to search for a constant for either valuation of the present position or to average past "intermediate" positions. If there were a search, we are convinced that it would be futile.

Informational Content of a Constant

In the various problems and constructs set forth in Part One we failed to find any to which a constant was relevant. All of the receivers were in a decision situation in which extant alternatives were relevant. The constant has nothing to do with alternatives, neither past, present or future. Thus, the "measure" by a constant has no economic significance or relevance to a problem. A constant having to do with temperature would be equally significant to the decision of the traders.

A constant has no self-information because it is meaningless. To prove the point we can take the opposite and prove that it is absurd. Suppose the trader thought that a constant was meaningful to him personally. Thus, he could value his wheat at

the constant irrespective of the market activities. This puts the trader in the enviable position of having possible gains but no possible losses. Any time the price was below the constant he could purchase and immediately profit. That profit would be maintained regardless of any further price fluctuations. The price of wheat could go to zero without affecting his valuation of his net worth. Under most circumstances a society would consider such a person insane. Anyone who presently thinks of himself as a millionaire, and especially if he acts as if he were a millionaire, because he holds Confederate money or South Sea Island Co. stock is very likely to find himself incarcerated.

It is impossible for the author to conceive of a constant being meaningful--having information content--to any receiver, with any problem, with any (rational) construct.

Summary

Our basic disagreement is with Boulding's assertion that all valcos are arbitrary. The purpose of this study has been to present criteria for the selection of a valco on a rational basis. Boulding could now charge that our criteria were arbitrary and thus conclude that the valco selected was arbitrary because of the nature of the criteria. From his other writings, however, it is evident that he would accept our informational criterion. Thus, there appears to be no fundamental disagreement.

Whether Boulding would accept our measurement criterion or not is not clear. From the absence of a discussion of measurement in his writings, we could conjecture that he does not think measurement theory is pertinent to the problem. From his insistence that an unequivocal profit can be determined only "when the process begins and ends with a single asset, e.g., money" we could conjecture that he does not think that a value-sacrifice dimension is appropriate.

Regardless of the validity of these conjectures it is important to point out that the absence of measurement concepts weakens Boulding's analysis. The "apparent paradox" of a fall in wheat net worth accompanied by an increase in money net worth would not arise if the valuation process is considered a measurement in consistent units. There are many other writers (both in Accounting Tradition and Present Market) who have been seduced by this apparent paradox. The entire argument over "replacement costs" is but a restatement of this paradox. Given the conception of a dimension, given the selection of units, the problem solves itself.

Measurements exist for the purpose of comparing different (heterogeneous) objects. For this reason, we are not impressed by Boulding's assertion that the objects must be in the same form (homogeneous) before they can be compared. It seems that at the very least we could make an unequivocal comparison by

stating a counter-factual condition.

> If I sold this wheat now, I would
>
> receive X dollars.

"X dollars" could then be compared to the "Y dollars" held previously and also compared to the future expectations. Thus, the statement provides an "answer sufficient for action" which is neither arbitrary nor ritualistic. A constant, on the contrary, is both arbitrary and ritualistic. More importantly, the constant does not provide an answer sufficient for action.

This last point is our major reason for rejecting the constant: it is not relevant to any problem that we know of. Given the lack of relevancy we can say that a constant is not information and therefore it is not appropriate for the measurement of income.

CHAPTER VIII

THE FISHER TRADITION

As we previously pointed out, Fisher disqualifies himself from the consideration of Enterprise Income. His concern is with personal income that involves a psychic satisfaction. Wealth increments of an enterprise are but intermediate steps toward that goal and, if they were called income there would be double counting. If we may reformulate Fisher's basic notion as "all productive activity is for the ultimate purpose of human enjoyment,"[1] then we agree. There is no disagreement with the notion that the ultimate resting place of income is with humans as opposed to land, capital or enterprises.

Fisher is also concerned with the wealth accumulation--with the valuation of capital--but he insists that the changes should not be called income. Fisher's disciples, particularly Lindahl, disagree with him on this point. They argue that the wealth increments, calculated by Fisher's method, should be included in income. Except for this semantic disagreement, the difference between Fisher and his disciples is negligible. The

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[1]He implies this in several places, e.g., p. 164. Irving Fisher, The Nature of Capital and Income (New York: Macmillan Co., 1906).

differences among the disciples are also negligible; they quarrel, but over technical points, not with the fundamental notion of valuation. For this reason, we can present one theory of valuation and say that it is "The Fisher Tradition" with little fear of distortion. Our basic source is The Nature of Capital and Income with minor modifications by his disciples.

The Fisher theory of value, and valuation, is elegant in its stark simplicity and logical rigor. An epitome of that theory follows.

First argument:

1. The motivation of humans is satisfaction.[2]
2. Goods are nothing more than vehicles for the production of that satisfaction.[3]
3. Therefore, the only reason for prising, valuing, a good is the satisfaction that it yields.[4]

Second argument:

1. Present satisfaction is preferable to future satisfaction.[5]

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[2]Ibid., see especially Chapter III on "Utility."

[3]Ibid., p. 151 et passim.

[4]Commodities are not income, only services. Ibid., see especially Chapter VI, Section 5.

[5]Ibid., passim. Cf. also Fisher, Theory of Interest for a complete statement of the impatience notion.

2. Goods yield only future satisfaction.[6]

3. Therefore, goods are prised less, are less valuable, than an equivalent amount of present satisfaction.[7]

Third argument:

1. Satisfactions equal income.[8]

2. Interest is a method of quantifying the preference for present income over future income.[9]

3. Therefore, the value of goods can be ascertained by discounting the income.[10]

Classification:[11]

1. Subjective-income is the final psychic satisfaction received by a person from the goods.

2. Objective-income is the actual goods which may be used to furnish the satisfaction.

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[6]Ibid., p. 165, where objective income leads to subjective income, i.e., goods lead to future satisfaction.

[7]Ibid., p. 227.

[8]Ibid., Chapter X.

[9]Ibid., Chapter XII.

[10]Ibid., Chapter XIII. Here is the presentation of the value of capital. Fisher does not discount "objective income" presumably because it is so near in time to subjective income.

[11]Ibid., p. 178.

3. Money-income is the amount of money actually received which may be used to purchase the goods to obtain the satisfaction.

Final conclusion:

The value of goods may be determined by discounting the future money-income.[12]

From this incomplete outline, it is easy to see why Fisher insisted that value increments were not income. Value increments are caused by anticipations of income and surely there is a difference between income and anticipation of income. If we accept Fisher's definitions, it is plain that income does not arise from value increments. Just the reverse, value increments arise from anticipated income.

The causal direction is of supreme importance in the Fisher analysis. Indeed, it would not be far wrong to sum up the purpose of The Nature of Capital and Income as an attempt to prove the causal relationship of income to capital. The causal order in its simplest form may be outlined as two corollary arguments:

Corollary A	Corollary B
1. Man seeks satisfactions.	1. Present satisfactions are preferable to future

[12] Theory of Interest spells this out in more detail.

satisfactions.

2. Goods yield satisfactions. Thus, man seeks goods.
2. Present goods are preferable to future goods.
3. Money obtains goods. Thus, man seeks money.
3. Present money is preferable to future money.
4. Capital goods yield money. Thus, man prises, values, capital goods.
4. Capital goods which yield money sooner are preferable to those that yield it later.
5. The value of capital is caused by its yield.
5. Interest is a method of quantifying the preference.
6. The value of capital goods may be ascertained by discounting the future receipts of money.

Obviously the receipt of money is different from the non-receipt of money. The receipt of money is income (money-income); the non-receipt of money is not income. An increase in anticipated receipts will increase the value of the capital goods but this increase is not to be included in income. Fisher makes this abundantly clear:

> That "saving" or increase of capital is not income coordinately with ordinary income is evident from the fact that this item is never discounted in making up capital-value. As we have seen, one of the fundamental characteristics of income is that it is the desirable event which occurs by means of wealth, and for the sake of which, consequently, that wealth is valued. This definition implies that every item of income is discounted in order to obtain its

> contribution to capital-value. The mere increase or decrease of capital-value, on the other hand, is never thus discounted. Suppose, for instance, with interest at 4 per cent, that a man buys an annuity of $4 a year, which does not begin at once but is deferred one year. Since this annuity will be worth $100 one year hence, its present value will be about $96, which, during the ensuing year, will gradually increase to $100. If this increase of value of (about) $4 is itself to be called income, it should be treated like every other item of income, and should be discounted. But this is absurd. The discounted value of $4, would be $3.85, which, if added to the $96, would require that the entire value of the property to-day should be $99.85, or practically the same as a year later instead of $4 less as is actually the case. In other words, the hypothesis which counts an increase of value as income is self-destructive; for if the increment is income, it must be discounted, but, if discounted, it is practically abolished. Clearly, then, increase of capital is not income in the sense that it can be discounted in addition to other items of income. If it is income at all, it is income in a very peculiar sense, and nothing but confusion can result from having to consider two kinds of income so widely divergent that whereas one is discounted to obtain capital-value, the other is not.[13]

Fisher's disciples disagree only on this last point. They argue that the change in the present worth (discounted value) of the future cash receipts plus withdrawals should be termed "income."

A good summary of The Fisher Tradition was recently presented by Hansen. He clarifies the issue by presenting profit

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[13]Fisher, Capital and Income, p. 248.

(income) as a pure valuation problem. He writes:

> As appears from the previous discussion, the profit of a period will generally be in conformity with the equation:
>
> $$P = W + E_u - E_p$$
>
> where
>
> P = the profit of the period,
>
> W = the realized income (consumption) of the owner(s), which can be positive or negative--the amounts actually withdrawn,
>
> E_u = the equity at the end (ultimo) of the period,
>
> E_p = the equity at the beginning (primo) of the period.
>
> In this equation E is quite clearly defined as the discounted value (the present value) of future withdrawals, while W equals the withdrawals in the period in question (the owner's consumption).[14]

It should be understood that this definition of income is identical to Fisher's "earnings." Fisher would call W the "realized income," i.e., the receipt of money by the owner is the "money income," and the change in E would be termed "appreciation" or "depreciation." The sum of the two is earnings.

> Expressed in a single sentence, the general principle connecting realized and earned income is that they differ by the appreciation or depreciation of capital. It is thus possible

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[14]Palle Hansen, The Accounting Concept of Profit (Amsterdam: North-Holland Publishing Co., 1962), pp. 39-40.

> to describe earned income as realized income less depreciation of capital, or else as realized income plus appreciation of capital.[15]

Because of this equivalence we have classified the disagreement between Fisher and his disciples as "semantic." It has been argued that the disciples are missing Fisher's fundamental point but it is clear that if they were willing to call their concept "earnings" there would be no disagreement.

There is one point of difference between Hansen and Fisher that is puzzling. Hansen makes it clear that the receipt of money by the owner must pass on to the subjective stage of income. The withdrawals are consumed. This appears to be in complete harmony with Fisher's general notion of the final residence of income. However, Fisher never states that the money income must be consumed if it is to be properly considered "income." He speaks of his concept including money-income, of measuring income and that any of the three (subjective, objective, money) may be considered separately. At the same time he goes to great pains to prove that the residue is only the subjective income. Thus, it is not clear whether or not Fisher would agree with Hansen that the withdrawals must be consumed in order to be part of this income.

This point offers no difficulties if one is willing to take E,

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[15]Fisher, Capital and Income, p. 238.

in Hansen's equation, as the total equity of the individual including unconsumed commodities and money. However, this interpretation means that we are taking to be income things that are only capable of becoming income. That is, if income is, after all, only consumption, then money is only an intermediate step toward income. But then so are capital goods an intermediate step, albeit one step further from the goal. Neither Fisher nor any of his disciples ever reconciles this point.

To put the question in its most elementary form: Why is money-income income? Is it because money is on the way toward consumption? But this is a question of fact. The receipt of money from a capital good may be used to purchase another capital good. Hence, we have money-income that is equivalent to an appreciation of capital, but capital appreciation is not income at all. Functionally, however, there is no difference between reinvested money-income and appreciation of capital.

One way to answer the question is to note that money-income is immediately transferrable to subjective-income. But then we are measuring what is capable, available to become income, not income per se. Yet this seems to be the only rational explanation of Fisher's distinction between earnings and income. The total earnings are not available for consumption; only that portion of earnings--realized income, money--that is available for consumption is income. However, if we follow this criterion--

wealth available for consumption--we reach a much broader concept of income. That is, money is available for consumption by exchange but then so is a capital good. Thus, everything that can be transferred, exchanged is income? But clearly the total value of a capital good is not income; it could only be the increment in value. But this is the appreciation which is part of earnings but not income. Still, in a market economy that appreciation is just as available for consumption as the money-income.

Fisher's disciples recognize this but their valuation procedure does not follow from the premise. The implied premise is

> "The incremental amount available for consumption plus that amount consumed is income."

The "availability" is given by the market prices. We agree that the market prices are caused by the future expectations of consumption but the cause of the availability is not part of the premise. If it is desired this income may be classified:

1. Subjective-income--the amount consumed.
2. Objective-income--the incremental commodities on hand that are immediately available for consumption.
3. Money-income--the incremental money on hand that is immediately available to acquire objective income.

4. Appreciation-income--the incremental
- capital on hand that is immediately available
to acquire money income.

The sum of these four categories, under the implied premise, is income and each have equal status. The transfer of one for the other, moving from (4) to (1), is defined, determined, by the present market price, not by any individual's expectations.

The reader may think that the author is reading in the implied premise and that it is not actually there. The author's impression of Fisher and his disciples is that the premise exists, albeit tacitly. Whether the premise is there or not, there are other problems in The Fisher Tradition which yield sufficient reason to reject it. As a decision making tool we have great respect for the Fisher notion[16] but we disagree with those who would use it for measuring wealth changes.

Since many writers leave the impression that all problems in The Fisher Tradition would be solved under certainty and since Fisher makes most of his analyses with perfect foreknowledge, we will begin our critique with a certainty model.

Discounting Under Conditions of Certainty

Our model is one of discrete movements of transcos at a

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[16]Much of "modern" decision theory is nothing more than a restatement of Fisher coupled with an awakened realization that bygones are really bygones.

point in time. The price changes at a given instant in time and the trader exchanges to a position that allows him to take advantage of this movement. Under certainty there can be no losses and the amount of the gain is known beforehand.

It is important to remember that this is the trader's best alternative. He has no opportunity to gain more satisfaction by consumption or to gain more command-over-goods by other entrepreneurial activities. In this case there is no reason to leave the funds idle if there is a possibility of gain. Thus, the trader will hold wheat anytime that the price is going to rise, no matter how small that rise, because there is no better alternative. If there was a better alternative this model would no longer be applicable.

We are now in a situation where the trader has an existing transco and perfect knowledge of the future transco. To make the example explicit, assume that the present transco is P_1 at T_1 and the future transco is P_2 at T_2. Assume further that P_2 is greater than P_1 so that the trader exchanges to a position of holding wheat.

No one in The Fisher Tradition suggests that the value is P_2 at T_1. Presumably because P_2 is in the future and, even though it be certain, the time-preference concept precludes it from being a present value. Instead, they suggest that P_2 be discounted to obtain the present value. Discounting involves a rate and a time period, the selection of which causes some

difficulties.

Rate Selection

We will begin by neglecting the time period problem and arbitrarily assume that the time is one year. Thus, in Fisher's usage, we have a "premium" rate of interest.

> This also may be readily shown by an example. If $100 will buy $4 a year forever, the first $4 being due one year hence, the buyer of such an annuity at the end of one year may, immediately upon the receipt of his first $4, sell out his rights. By hypothesis they will bring $100. Consequently, he receives $104 in all for his $100 a year ago. He has thus virtually exchanged $100 one year for $104 the year after. That is, the premium rate of interest for this year is also 4 per cent.[17]

Fisher continues to show the equivalence of the premium concept to various other concepts. These are well enough known to omit here and we can generalize the above statement as follows:

$$\frac{P_2Q_1 - P_1Q_1}{P_1Q_1} = r \qquad \text{(eq. 1)}$$

Which is equivalent to

$$\frac{P_2 - P_1}{P_1} = r \qquad \text{(eq. 2)}$$

Solving for P_1 yields the discounting equation.[18]

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[17]Fisher, Capital and Income, pp. 197-198.

[18]"In other words, the rate of interest is, briefly stated, the ratio between income and capital." Ibid., p. 191. Here Fisher calls this the "realized rate."

$$P_1 = \frac{P_2}{1 + r} \qquad \text{(eq. 3)}$$

Fisher does not consider an alternative rate and we see no reason to use any other.[19] Note, however, that this is circular and that the discounting equation will always result in valuing the wheat at P_1 at T_1. Thus, the value of the wheat at entry is the market price at the time of entry. This conforms to our earlier conclusions and we agree.

The problems arise if we want to make an interim valuation. We define the interim instants as $t_1 = T_1$ and $t_n = T_2$. Now if we want to make a valuation at, say, t_3 there are two different possibilities:

1. The exchange alternatives are available only at T_1 and T_2.
2. The exchange alternatives are available at interim instants.

The locked-in case.--If the trader purchases wheat at T_1 and there are no further exchange alternatives available until T_2, we say that he is "locked-in" the market. This may be Fisher's assumption. The above quote indicates that he considers the bond-holder to be locked-in for the year, i.e., although he can

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[19]For different purposes there may be different rates. For example, a pure rate of interest might be applied in order to distinguish pure profits from return on capital. However, the purpose is to analyze (separate) the income, not to determine the total.

exchange at the end of each year there are no exchange alternatives during the year. In other connections the locked-in interpretation seems plausible also.

> We have then two methods of defining interest. In both of them the time element is prominent. Before passing on we should here remark that the time element enters not only as referring to the times of payment but also to the time of contract. A rate of interest implies not only the two points of time between which the goods for exchange are available, but also the point at which the decision to exchange them is made.[20]

Although Fisher's later examples do not completely confirm the locked-in assumption, the gist of the presentation indicates it. However, it makes no difference whether this is or is not Fisher's assumption. We will consider the case as one of the two possibilities that need analysis. It is clear that he would value the wheat contract by using the discount rate in equation 2. That is, he would discount P_2 for the period t_3 to T_2 at r.

The result would be a value increment which Fisher denies to be income. This is perfectly consistent with his other positions.[21] Note that if he were to contend that the value increment was income this would put him in the rather peculiar position of saying that temporal location produces income. The trader has

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[20]Fisher, Capital and Income, p. 196, emphasis supplied.

[21]Including the notion that the "return of principle" is no different from other receipts and therefore the principal becomes "income" when it is received.

no alternative at t_3, there is no transco at that time, therefore there is no available consumption. Likewise, there is no available money nor any command over goods. In fact the trader's position at t_3 is worse than at T_1. At T_1 he had money and all of the alternatives consequent of holding money but he has had an "outgo" which obviates those alternatives until T_2.

Under such conditions it is easy to see why Fisher would argue that a value increment is not income. The trader has nothing at t_3 and nothing is clearly not income. But if we take this line of argument it also leads to zero value at t_3. The trader has nothing and nothing is clearly not value.

It may be argued that the trader does have something at t_3, viz., a certain future income and value. But how does one measure the future? How does one value a single "alternative?" We have pointed out that the future cannot be measured and further that the valuation was a decision, selection among alternatives. This trader has no alternatives to choose between, to value; he has only one certain outcome.

Still, Fisher's answer is to discount P_2 for the period t_3 to T_2. In order to make his position clear we present the following:

> We may, if we choose, trace the history of the value of a security from the time immediately before its purchase, and consider the purchase price itself as an outgo. If this price is exactly equal to the discounted value of the succeeding income, it is evident that the value immediately before its purchase must be exactly zero. Thus in Figure 6 let OM be the purchase price, and

equal to OA, which is the capital-value immediately after purchase. The capital-value immediately before purchase is, therefore, zero, and the entire capital curve is the line OABCDEFH, which starts at zero and ends at zero, but is above the zero line at all intermediate intervals.[22]

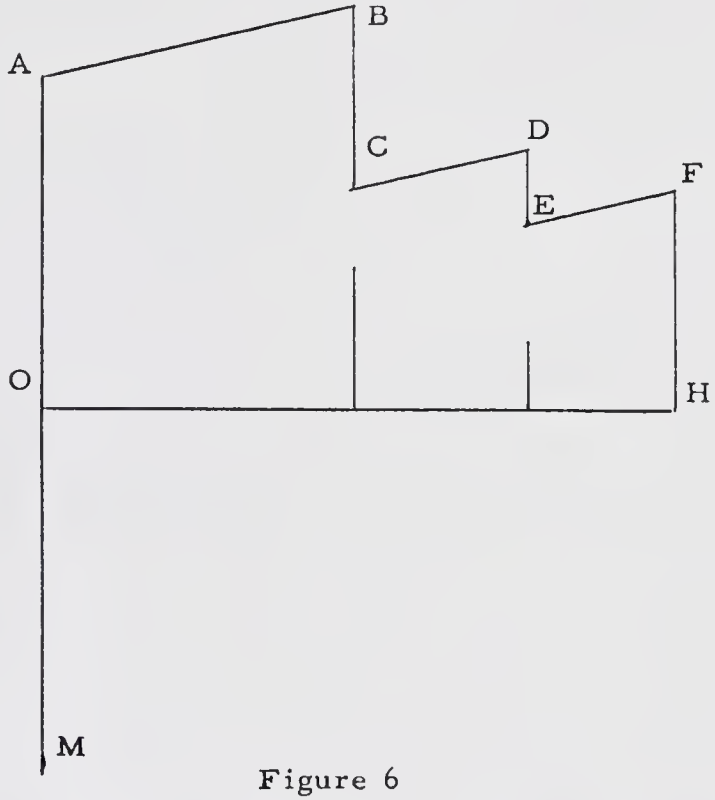

Figure 6

We can abstract from Fisher's Figure 6 and use his reasoning on our locked-in assumption.

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[22]Fisher, Capital and Income, pp. 219-220.

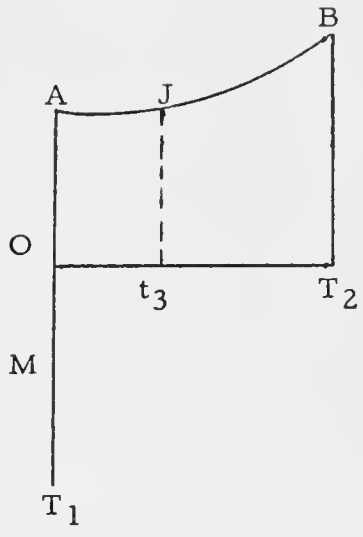

Figure 16

The value at t_3 is the distance from t_3 to J. Note however that this assumes that value accrues, accumulates, in the indicated pattern over the period and there is no evidence for that assumption. On the contrary, there is evidence that value occurs precisely at T_2. It must be granted that at T_1 the trader valued this contract more than money. Further, we can measure the sacrifice, OM, and then ordinally measure the value as OA. However, this was the valuation at T_1. There is no valuation at t_3 in the sense of sacrificing alternatives. Thus, it is just as reasonable to say that the value at t_3 is zero and will remain zero until T_2.

One may argue that the value is not zero at t_3 because the trader receives feelings of security, pleasure, etc., from

contemplating his future. In other words he receives satisfactions from his position at t_3. But satisfaction, in Fisher's terminology, is income! It is not value.

Thus, if one measured the satisfactions of the trader he would get income; if one measured the sacrifice he would get zero. The only way to get value equal to t_3J is to make it so by definition. However if we allow this, it is easy enough to define any other curve and get any other value.

Thus, the locked-in case, even under certainty, does not yield an unassailable rate nor a univocal value. Let us relax the locked-in assumption and see if a continuous alternative yields a satisfactory rate.

The Assumption of Continuous Alternatives.--We will continue the same assumptions as above--perfect foreknowledge and a discrete move in price to P_2 at T_2--except that the trader will be allowed to exchange at any of the interim instants. We can still figure the rate as the difference between P_2 and P_1 divided by P_1. There is the problem, however, of adjusting the rate for the time that the trader holds the wheat. If the trader exchanges at T_1, the rate will be "per year." The trader could exchange, under the assumptions, at any of the interim instants from t_1 to t_{n-1} and gain the difference between P_2 and P_1. The quotient of equation 2 (r) will remain constant for all the instants but when r is adjusted for time, put on a comparable temporal basis, it will vary widely between an exchange at t_1 and t_{n-1}.

Thus, even for the purposes of analysis such a rate is useless. That is, if some rate is selected--e.g., time preference, reservation rate, pure interest, rates of alternatives--for analysis, the surplus, economic rent, pure profits, etc., would vary greatly depending upon the timing of the exchange. There is no reason for the trader to exchange before t_{n-1} and have a large surplus. On the other hand, there is no reason for him not to exchange before t_{n-1} (this is his best alternative) and have a small surplus. The rate and the surplus depend upon the whim of the trader.

An opponent may reply that this is a misuse of the rate. That the rate is for the total gain over the entire period. We cannot object to this conception of the rate but it is clear that this is an ex post concept from T_2 and is not useful in interim valuations. If the trader does not exchange until t_{n-1}, he holds money at all other interim points. If we want to value at t_3 then, and use the implied rate, we are in the incongruous position of valuing money at more than unity. Surely no one would maintain that the valuing agent, the unit of value, was more valuable than unity. This would be tantamount to claiming that a meter had more length than a meter. It simply does not make sense. We repeat, however, that if someone wants to view the past events from T_2 and express the change as a rate, there is no objection. Indeed such a rate may be quite useful in adjusting data for comparisons, but it is not useful for measuring value at t_3.

The same reasoning can be applied to a series of discrete price movements of different magnitudes. One can take an ex post view at any of the instants and calculate the average rate from some previous instant. This can be done whether there has been one price change or many, whether there has been one exchange or many, and the average ex post rate may be used for making the data comparable. However, each of these price changes and exchanges will have interim instants identical to those analyzed above and the conclusion holds.

The reader may complain that the above assumptions are unrealistic. Seldom, if ever, is one locked-in a market. "Secondary" markets exist for almost everything.[23] Likewise, a discrete price movement under certainty has an unreal sound. A more realistic situation would be for the price to be "continuously" bid up as time passed.[24]

All of the traders would bid on the wheat until the rate was equal to the marginal trader's next best alternative. As time passed the transco would increase from P_1 to P_2 in interim

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[23]Even trust funds have developed a secondary market. One can now sell the rights to a future receipt in direct abrogation of the intent of the trust.

[24]It is difficult to conceive of a continuous price increase because our money is not infinitely divisible. A more accurate description would be "very small discrete price movements over very short time periods." For brevity we call this "continuous." However, the lack of continuity does bring up some accrual problems which we will consider below.

steps, p_1 to p_n, corresponding to the interim instants. This may be visualized in Figure 16.

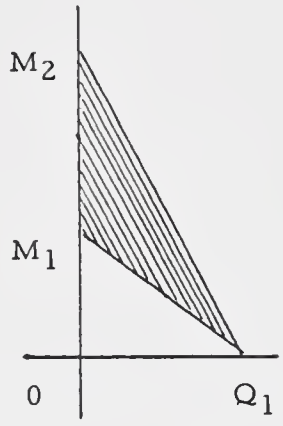

Figure 17

This situation is much more realistic. It is tantamount to a government bond market with a pegged interest rate. If the rate is better than the trader's next-best alternative, including being high enough to overcome his impatience, he will hold wheat. Again there may be reason to analyze his income into various parts. He may have a reservation rate below the market rate and thus receive a surplus of the difference. However, if our purpose is to measure the total value, such an analysis is not relevant.

The alternatives are relevant and these are expressed as transcos at some temporal location. The rate is nothing more than a convenient means of calculating the transcos at different instants. If the market price is being continuously bid up as

time passes, the discounted value of P_2 is always equal to the present transco. Thus, under these assumptions, where the rate seems to be most relevant, the truth of the matter is that it is unnecessary. The present transco yields the correct "Fisher value" without bothering to utilize the Fisher valuation method.

One further variation on the assumption will complete the certainty case. It may be assumed that some traders have foreknowledge that is superior to other traders. In other words, there are some traders operating under conditions of certainty and others who have some degree of uncertainty. If our trader be one of the latter, the analysis presented below, when we relax the certainty assumption, will be pertinent. Thus, for purposes of this analysis, we will assume that our trader is omniscient in a market where others are uncertain.

For example, assume that the trader knows the complete pattern of prices from T_1 to T_2. However, because of the uncertainty of the other traders the price between T_1 and T_2 does not follow the discount path. The price moves sporadically and irregularly from P_1 to P_2 over the time T_1 to T_2. Now it may be argued that, since the trader is certain of the final outcome, P_2, the correct valuation at the interim instants is P_2 discounted by the implied rate. The argument will not stand, however, because this situation reverts to the locked-in case.

Note first that, if the interim prices moved up and down, the trader could gain more than the difference between P_2 and

P_1 by making interim exchanges. Thus, the implied rate is not applicable. A rate can be determined by calculating the gain from each individual exchange and then averaging. Or the quantity of money after the "final" exchange at T_2 can be figured ex ante and then a rate figured as

$$\frac{M(T_2) - M(T_1)}{M(T_1)} = r_1 \qquad \text{(eq. 4)}$$

But clearly this is an <u>average</u> of all the interim exchanges and is subject to the same criticism of averages that was presented above. The trader may be holding money because he knows the price is going to fall. Application of the average rate will result in valuing money at more than unity.

Since he knows that he is moving inexorably toward $M(T_2)$, it may be that he <u>feels</u> that his money should be valued at more than unity. Note, however, that the excess above unity is locked-in the market and is subject to the criticism presented above. At other times the discounted value of $M(T_2)$ will be less than the money held. Is it possible to contend that the trader <u>feels</u> that his real value is less than the money held?

This example is, of course, caged so that it violates the assumption of unequivocal measure of income under conditions of a completed exchange. We may alter the conditions so that the exchange is not completed until T_2, however, and get similar results.

If the price movements are all upward there is no reason to complete the exchange. Let us make that assumption and further assume that the discounted value of P_2 at t_3 is p_3 but that the transco at t_3 is p_2. If we value at t_3, should we select the discounted value, p_3, or the transco, p_2?

It has been noted that p_3 is an average over an arbitrary time period that has nothing to do with alternatives. On the other hand, p_2 is an alternative relevant to the continuing decision and is the current sacrifice. It is true that P_2 is certain to be eventually realized and it may even be granted that it is reasonable to assume a pattern that yields p_3 at t_3. However, P_2 is locked in the future and thus the difference between p_3 and p_2, d, is locked-in the market. In order to garner d the trader has no alternative except to stay in the market until T_2. Thus, the valuation of d reverts to the locked-in case. As we saw above, valuation in the locked-in case requires an assumption about the pattern of value accumulation. Further, that from a sacrifice or decision viewpoint the most reasonable assumption is a zero valuation if we are truly locked-in. The same reasoning applies here: d does not become a value until T_2; it does not accrue over time, it occurs at an instant.

Moreover, d's existence depends upon an arbitrary time period selection. We averaged the rate of return from T_1 to T_2 to find p_3 which was used to find d. The time period T_1 to T_2 is

a reasonable one if there are no other alternatives during the period. In this case, however, there are other alternatives. The trader may discover a better opportunity in another market at t_3 and exercise his alternative by exiting from the market. Thus, d would never become a value and it would make more sense to average (if there is a compulsion to average) from T_1 to t_3. Of course, if this was done, d would not exist at t_3. Likewise, other traders could enter the market at t_3. Their average rate would be for the period t_3 to T_2 and d would be zero at t_3. Because of the existence of these continuous alternatives, the time period over which the average is calculated is completely arbitrary. Since the time period determines the rate and the rate, in turn, determined d, we may conclude that d is completely arbitrary also.

The results of arbitrary valuation are almost certain to vary. Traders entering and exiting from the market at different times are almost certain to average over different time periods. Even those entering at the same time are very likely to use different periods for their average. The result is that identical objects in identical spatio-temporal relations receive different "measurements." One wonders just what kind of comparisons can be made under such circumstances.

Under the assumption of discrete price movements we described a locked-in case and concluded the most reasonable value was zero. Under the assumption of continuous alternatives

we have described a quasi locked-in case. A case where a portion, d, of an average certain future is locked-in. For the reasons presented, it seems perfectly clear that this portion should also be valued at zero. With d equal to zero the value left is the present transco.

Summary

We have taken a rather detailed excursion into the problems of valuation by discounting under conditions of certainty. Several variations on the assumptions have been explored and the conclusions for each have essentially been the same. These conclusions may be outlined as follows:

1. The rate selected should be the one implied by the transcos. Other rates have no bearing on the problem of valuation.
2. The rate has a time dimension. Transcos occur at a point in time and different points yield different rates and different interim values.
3. To calculate the present value, the present instant should be selected as a starting point for discounting. This always yields the present transco and thus, the rate calculation is superfluous for valuation purposes.
4. If other arbitrary time periods are used, one

> is in effect assuming a pattern of value accumulation that has no relation to alternatives, decisions or sacrifices. The difference between the assumed pattern and the actual alternative is locked-in market. (Including the complete locked-in case where there are no alternatives; when the sacrifice is zero at interim instants.) The amount that is locked-in should be valued at zero thus the value reverts to the present transco.

In short, even under conditions of certainty, even on Fisher's own ground, we find that for purposes of valuation, the discounting process is at best, superfluous--yields identical results to other more direct methods--and at worst, demonstrably wrong.

Little use has been made in this section of the more generalized information--measurement criteria. We could object that The Fisher Tradition is a prediction instead of a measurement but, under certainty the results are identical. Thus, any such objection would be more on grounds of technicalities than substance and therefore we have not raised it.

Likewise, it is difficult to conceive of "information" when everyone is certain of the future. With perfect foreknowledge the only thing needed is a time-piece in order to know what

has happened. In the case of the one omniscient trader it is not likely that he would let us in on his secret and thus we could not transmit information about the future with certainty. If by some chance he was willing to share his foreknowledge, this would be the most valuable information conceivable and would take priority. This also is unrealistic. The more realistic situation is uncertainty and that is our next task.

Valuation Under Uncertainty

In the above analysis we assumed that the trader had foreknowledge of the transcos. Thus, we could focus upon a single outcome and discuss the problems of discounting that outcome. Under the more realistic conditions of uncertainty there is a range of possible outcomes and we will be forced to select a single number from this range before we can discount. That is, we must decide what the future value is before we can obtain the present value. The future value must be known in order to discount it at a given rate to obtain the present value. But the rate also must be determined and, as we indicated above, we need to know both the present value and the future value in order to determine the correct rate.

Fisher attempts to divide the issue into two separate problems: (1) uncertainty in the rate and (2) uncertainty in the final outcome. He does this by using the "present rate of

interest" to make the initial valuation and then adjusts the value as the "present rate" changes in the future. Only after the discussion of the rate does he venture into the problem of determining the final outcome and he never attempts to combine the two.

Unfortunately, only the last chapter of the fundamental work--The Nature of Capital and Income--is devoted to uncertainty.[25] Furthermore, much of this chapter is concerned with insurance vice valuation. Because of the minute portion of analysis devoted to valuation under conditions of uncertainty, it is difficult to know precisely what Fisher thought. He begins the chapter by relaxing the certainty assumption and presenting a few general remarks on chance.

> Throughout the three previous chapters, we have assumed the existence of artificially simple conditions. We have assumed that the entire future history of the capital in question is definitely known in advance; in other words, we have ignored chance. The factory which was taken for illustration was supposed to yield definite future income which could be counted upon as a bondholder counts upon his interest.[26]

The previous chapter's valuation method under certainty is presented as

> A merchant's balance sheet is a statement of the prospects of his business. Each item in

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[25]Fisher, Capital and Income, Chapter XVI, "The Risk Element," pp. 265-300. This is the last chapter of analysis. There are succeeding chapters but they are summaries of the previous analyses.

[26]Ibid., p. 265.

> it represents the discounted value of items [receipts of cash] which he may expect [be certain to] later to enter in his income account.[27]

Presumably the rate of interest used in this discounting process is not drawn from a hat but Fisher never clarifies its origin. He says only, "supposing the rate of interest to be 5 per cent,"[28] and then proceeds to use 5 per cent throughout without further discussion. However, since he is never bothered with adjustments to the capital account the rate must be equal to the "realized rate." Under uncertainty, however, the realized rate could be determined only ex post. Whether or not he calculates the rate in this fashion is not known, but any other rate would require adjustments; therefore it is reasonable to assume that the way he gets the 5 per cent is by an ex post calculation.[29] It is quite a

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[27] Ibid., p. 264.

[28] Ibid., p. 256.

[29] The above appears much too obviously a vicious circle for a man of Fisher's ability to fall into. We hope we are not doing him an injustice but there seems to be no other way to get the rate. We could assume that the 5 per cent was a pure time-preference or reservation rate but the existence of different preferences would yield surpluses to all except the marginal investor. Likewise, we could assume perfect competition but the rate of all except the marginal producer would yield surpluses also. Assuming that the rate is determined in a separate market--the money market--does not help either. The rate paid in the money market has to be high enough to overcome the consumer's impatience but it has to be lower than (or equal to) the return on the capital into which it is invested. But the calculation of the "return on the capital" requires both the present and the future value.

We repeat: for decision-making purposes the discounting

different matter to get an ex ante rate under uncertainty and therefore one would hope for a rather complete explanation. Unfortunately anyone who has such hopes is due for a disappointmnet.

Fisher sets the stage by noting that chance brings about "even more important changes in capital-value,"[30] than the changes met when the future is certain. The price changes (equal to capital value?) are due "chiefly... [to]...changing estimates of futurity, due to what is called chance, rather than of a record of the foreknown approach and detachment of income."[31]

After a few pages of discussion of the concept of chance and probability, he divides the problem.

> In order to apply this theory of chance to the valuation of capital, we observe that both the future rate of interest and the future items of income are uncertain.[32]

However, the future rate of interest is then denied to be a problem.

> In the problem of capital-valuation, however,

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procedure is useful and valid. We can discount (by a reservation rate) a future sum and make comparisons or we can calculate the rate on two alternatives (by using the present and future values) and make a decision. However, any other method of determining a rate is beyond the author's comprehension.

[30]Fisher, Capital and Income, p. 265.

[31]Ibid.

[32]Ibid., p. 271.

> the uncertainty in the rate of interest does not always enter, for only present and not future rates are employed at the time at which the valuation of capital is made.[33]

But how do we get the "present" rate of interest? A rate, by definition, covers a time period. It is not an instantaneous amount. Is it the rate that was earned on the last trade? Is it an average from some previous time? Is it a reservation rate? Fisher says it is a rate which applies to the present contract. But to know the rate which applies to the present contract requires that we know the future outcome of that contract and this contradicts the assumption of uncertainty. The full quote follows:

> When we call a rate a "present" rate we mean, of course, that the contract or estimate to which it relates is a present contract or estimate. The very fact of valuation implies a known rate or rates at which the valuer is contrasting present and future goods. There may be several "present" rates. [Examples of different rates for different length contracts are presented.] All of these rates are fixed and known and hold true in the year 1906, [the present] but they do not determine the rates which will hold true for the contracts or estimates of 1907 or 1914.[34]

It seems clear that Fisher is implying an exogenous rate here that is "known and holds true." That is, there is a rate that is given to us from an outside source and that rate is the proper one to use for valuation. He seems to indicate this in other places

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[33] Ibid.

[34] Ibid.

when he speaks of the "ordinary rate" and "earnings above the rate." Apropos of our study he writes:

> Those who believe that wheat or any other article is likely to rise in value and hence yield more than the "rate of interest," will hold it...[35]

The quotation marks are extremely puzzling. If it is an exogenous rate then there is a chance to earn more than the rate of interest and there is no need to add the quotes. Another way of interpreting the quote, however, is to calculate the rate as in equation 2 and thus indicate by quotation marks that the exogenous rate is not the "real" rate. We are confused.

Fisher continues with an example of the interest changing in the interim. In order to discuss the problem in Fisher's own terms we present this rather lengthy quote:

> Let us suppose that in Figure 10 the income AB is due at the end of the time FA, and that the rate of interest is such as to produce the discount curve BE. Then the present value of AB is FE. But the future valuations of AB may not follow the line EB as they would were the rate of interest unchanged. Thus, at a midway point of time, G, the valuation of AB may be only GD, found by means of a higher rate of interest involving the steeper discount curve DB. The history of the value of the property, namely, the right to AB, therefore follows the broken line ECDB, abruptly changing from GC to GD, if we suppose G to be the point at which the rate of interest changes unexpectedly from one level to the other. Had the owner of the property foreseen at the

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[35] Ibid., p. 298.

start that when the point G was reached the rate of interest would be higher, he would have taken this fact into account in valuing

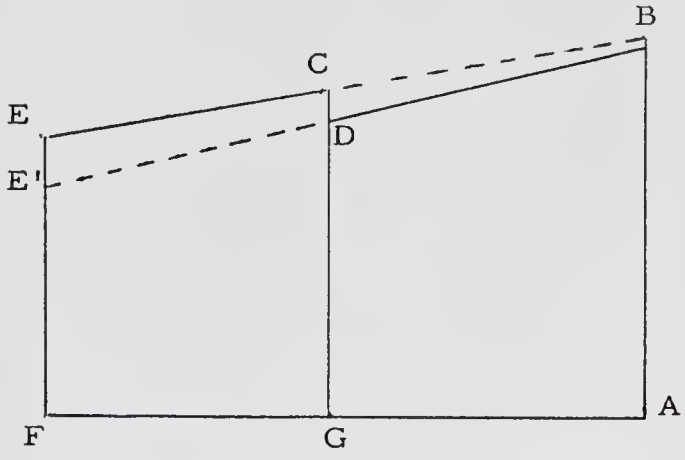

Figure 10

the property at the moment F, and the value would have been FE', found by using the discount curve BDE'. This curve has a slight angle at D, being composed of the curve BD, constructed according to the high rate of interest prevailing at the time G, and the curve DE', constructed according to the lower rate of interest which applies to the period FG and which was employed in the curve EC. The essential fact, therefore, is that because of the failure to foresee the future rise in the rate of interest, the value of the property is FE, instead of FE', and that the value of the capital will fall, as at CD, or it may be rise, in accordance with successive future adjustments in the rate of interest. Since these readjustments are usually small and gradual, fluctuations in the capital-value will not ordinarily be as great or as abrupt as here represented, but the principle involved will still hold true. We see, therefore, a new cause for the fluctuations in capital-value, namely, unforeseen changes in the rate of interest.[36]

[36]Ibid., pp. 271-273.

Suppose that we expect to receive $110 (AB) one year from today. The exogenous rate (however determined) is 5%. Thus, the present value is $104.76 (FE). If the market price at F is $104.76 there is no problem. The exogenous rate is equal to the implied rate. However, if we paid $100 for the contract at F, several questions arise.

The value of the consumption sacrificed is $100. We have $100 from some previous source that is immediately available for conversion into enjoyable capital and then into satisfactions. (Compare Figure 27, p. 315, for Fisher's saw-tooth changes in money which change enjoyable capital by the same amount, i.e., they are of equal value.) Thus, we have $100 of value at F but when the contract is purchased the value increases to $104.76. From whence the $4.76? After the exchange is completed the trader has $110 of value. Thus there is a value increment of $10; an increment in money which is equal to the increment in enjoyable capital; $10 of separated, "realized income." Yet only $5.24 is accounted for by the exogenous rate. The realized rate is 10% but this can be determined only ex post under uncertainty. In short, the exogenous rate does not exhaust the amount which Fisher terms "income." Thus, an adjustment would be required.

Fisher's disciples make it clear that they are using an exogenous rate, viz., the "subjective" rate. They also recognize the problems of adjustment that arise under conditions of

uncertainty and spend a considerable amount of effort on these adjustments. However, the analysis of adjustments is invariably presented as a result of changes in expectations. Not as a result of the subjective rate differing from the realized rate. Hansen briefly mentions the problem in a summary:

> Furthermore, it should be pointed out that throughout the previous discussion complete identity has been assumed to exist between the anticipated and the "realized" subjective rate of interest. At this point discrepancies may also occur, which may cause the described ideal and ex-ante concepts to take on a different content to that found during our discussion.[37]

Hansen recognizes the problem but there is no further mention of it beyond this brief passage.[38]

If we interpret Fisher's Figure 10 in Hansen's terms it does not make sense. Evidently the "subjective rate" has to do with the trader's personal, internal, psychic "feelings." The trader's feelings at F were, say, 5 per cent. (Assuming that a trader can "feel 5 per cent.") He expects AB at instant A and discounts by 5 per cent to obtain FE. At instant G he changes his feelings to, say, 7 per cent and discounts AB at that rate for the remaining time, resulting in the lower value of GD. Note

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[37]Hansen, The Accounting Concept of Profit, p. 38, emphasis supplied.

[38]Note that this is not purely a problem of uncertainty. A "subjective" rate could be used that is different from the certain-to-be-realized rate and the adjustment would still be required.

that two things remain constant during this entire exercise, viz., the expectation (AB) and the entry price (unspecified).

The trader's feelings about interest is the only variable in the entire process. Normally we would think that, if the expectations changed, there would be a change in the rate. We could understand a change in prediction of the final outcome and would have no objection to that change being expressed as a rate. But a change in feelings about a rate is beyond comprehension. Clearly such feelings have nothing to do with Fisher's explicit assumptions of economic motivation because they have nothing to do with consumption, enjoyable capital, money or any other economic concept. They could be nothing more than a psychological curiosity which would have relevance only to the trader's analyst.

For the reasons presented it is reasonable to assume that Fisher was not speaking of a subjective rate.

After he gets into the problem of changing expectations of final outcomes, he defines three linked rates: (1) riskless, (2) mathematical and (3) commercial. He then selects the commercial rate.

> The question sometimes arises, where the element of risk thus raises the basis on which the bond is sold, whether the 6 per cent [commercial rate] is a true "rate of interest." The question is purely one of definition. Were it possible, it would be simpler to confine the application of the phrase "rate of interest" to an exchange

> between present and future riskless income.[39]

Note that the calculation of such an exchange is determined by equation 2. Thus, it is not exogenous but is the quotient of an equation in which both the present and future values are known or are estimated. He continues:

> But in this case, it is always exceedingly difficult to state what the riskless rate of interest is, since some slight risk attaches to almost every investment. Accordingly it is usual to regard the commercial rate as a true "rate of interest."[40]

From the rest of his discussion it is clear that the commercial rate's chief use is to determine what the contract ought to sell for. That is, given the elements of risk and time-preference an individual could calculate the maximum that he, personally, would be willing to pay by discounting at the commercial rate. But if anyone buys at less than this maximum, an adjustment is required. Everyone in the market except the marginal trader will purchase at less than the maximum and thus an adjustment will be required for all traders, save one.

In the case of "surplus consumable funds" the reservation rate is zero. Any time that there is any positive rate the trader will exchange in order to gain something instead of nothing. Thus,

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[39]Fisher, Capital and Income, p. 279, emphasis supplied.

[40]Ibid., pp. 279-280.

an adjustment is required for the entire amount of the gain.[41]

We feel that all of these difficulties with the rate make it incumbent upon Fisher's disciples to explain their valuation suggestions in some detail. The author cannot solve the problems and therefore we will leave the question of rates and turn to Fisher's second point.

Determination of the Final Outcome

> The main application of risk to capital valuation is, however, not the rate of interest, but the income items themselves. To this application we now address ourselves.[42]

Following Fisher we will now address ourselves to these items of income (or in our terminology the determination of the future transco) and neglect the problem of rate determination.

Fisher begins by explaining the concept of "mathematical expectation," E, which he calls the "mathematical value." As we explained above, the trader facing uncertainty is likely to perceive a range of various outcomes and have some notion of the probability of those outcomes. The mathematical expectation is a formalization of the range and the probabilities.

We will posit that the decision method used in this model is based upon an E calculation. This is a legitimate assumption

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[41]This case is not as far fetched as it may appear. Certainly in the extreme example of a Rockefeller with the chore of consuming $65 million there would be surplus consumable funds. These funds would be employed in the best alternative with a zero reservation rate.

[42]Fisher, Capital and Income, p. 275.

for rational decision making and we are quick to give Fisher credit for presenting it as early as 1906. E serves as a signal for action: if it is positive, hold wheat; if negative, hold cash.

A risk model.--The variables will be easier to handle if we assume a gambling-type model, e.g., like rolling dice or flipping coins. The characteristics of such a model allow us to list all the possibilities and assign a priori probabilities.

This assumption is unrealistic of course. When dealing with prices there are an infinite number of possibilities and no a priori probabilities. None-the-less, we will make the assumption in order to clarify the valuation problems under the simplest of conditions. If the problem can be solved in this case it should point the way in a more realistic case; if it can not be solved in a simple case, there is no reason to expect that the addition of complexities will make it more amenable to solution.

In addition, we use this model because Fisher's analysis is exclusively under conditions of risk--as opposed to uncertainty--although he never names the assumption. Thus, our criticism will be directly relevant to Fisher's valuation suggestions. He begins by assuming a magnitude that is certain to occur but uncertain as to the recipient of that magnitude, i.e., a lottery. He then multiplies the certain magnitude by the probability of receiving that amount and terms the product the "mathematical value." After further adjustments for "caution"--which we neglect--he obtains the commercial value which is the correct

valuation for balance sheet purposes.

Later he presents a case which is more relevant to our problem.

> In the general case we have to do not simply with the risk of falling below a specified income, nor with the chance of rising above a specified income, but with both.[43]

"Income" here is "realized-income" or receipts of cash. His example is on the basis of a stock which pays cash dividends.

> For instance, in the case of stock which has yielded, in successive years, the following percentages: 5, 5, 6, 5, 5, 4, 5, 7, 5, 3, 4, 5, we may for convenience take 5 per cent to serve for a basis for computation.[44]

Here is the rate problem again. "Yielded" implies a base which, when divided by the cash dividend, gives the percentage (rate). The purpose of the discussion is to discover the correct base; therefore it is impossible to state the example in terms of a rate (yield) prior to the discovery. But the base is determined by using a rate which insures that the yield will be equal to that rate. Let us neglect the rate problem and follow along with Fisher's discussion.

> Thus, the "riskless" value, in this case, signifies that value which the stock would have if it were certain to yield the (arbitrarily assumed) 5 per cent forever--never more and never less. The riskless value is

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[43] Ibid., p. 281.

[44] Ibid.

> therefore simply the capitalized value of a perpetual annuity of $5 per share of $100 face value. If the rate of interest is 4 per cent, the result is $5 divided by 4 per cent, or $125.[45]

The assumption of perpetuity is important here. It seems to imply the locked-in case again, because if there was any chance that the principal would be returned and the dividend stream discontinued, the present worth would be vastly different.

Fisher continues in a rather roundabout fashion to calculate the mathematical value.

> To obtain the "mathematical" value we simply add to the riskless value the value of the chance of getting more, and subtract that of the chance of getting less. The chance of getting an additional $1 a year is found by experience, as set forth above, to be two in twelve, or 1/6 each year. The present value of the right to this chance has therefore a mathematical value 1/6 as great as though the $1 increment were a certainty. But the certainty of $1 a year would be worth $25. Hence a chance of 1 in 6 of getting $1 a year would be worth mathematically 1/6 of $25, or $4.16 2/3. In like manner the chance of a second additional dollar is one in twelve and is worth (mathematically) 1/12 of $25, or $2.08 1/3. These two terms, $4.16 2/3 and $2.08 1/3, are the additive terms sought. The subtractive terms are the mathematical value of the chance of getting $1 less than the $5, and of getting still another $1 less. These chances, being 3 in 12 and 1 in 12 respectively, are worth 3/12 of $25 and 1/12 of $25 respectively, or $6.25 and $2.08 1/3. The whole mathematical value is therefore $125 + ($4.16 2/3 + $2.08 1/3) - ($6.25 + $2.08 1/3), or $122.91 2/3.[46]

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[45] Ibid., pp. 281-282.

[46] Ibid., p. 282.

This is equivalent to capitalizing E by 4 per cent. The general form of E is

$$E = \sum_{i=1}^{n} \emptyset_{(A_i)} \cdot A_i$$

where

$\emptyset_{(A_i)}$ = probability of A_i occurring,

A_i = amount gained or lost when event A_i occurs.

In this case

$$E = 3(1/12) + 4(2/12) + 5(7/12) + 6(1/12) + 7(1/12)$$

$$E = 4.91\ 2/3$$

Then E capitalized by 4 per cent is

$$\frac{4.91\ 2/3}{.04} = 122.91\ 2/3.$$

Thus, approximately $123 is the amount that a person should pay for the right to obtain this income.[47]

Fisher sets up saw-teeth curves which show the value gradually accruing as the dividend payment date is approached and then abruptly falling off when the payment is detached. The rate of accrual in this example is 4 per cent, thus the capital value would follow the pattern in Figure 16, rising from $123 to $127.92 ($123 plus 4 per cent of $123) and then falling back to $123.

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[47]Again we neglect the further discounting by the coefficient of caution. If we included it, the amount paid would be lowered further and the discrepancy would widen.

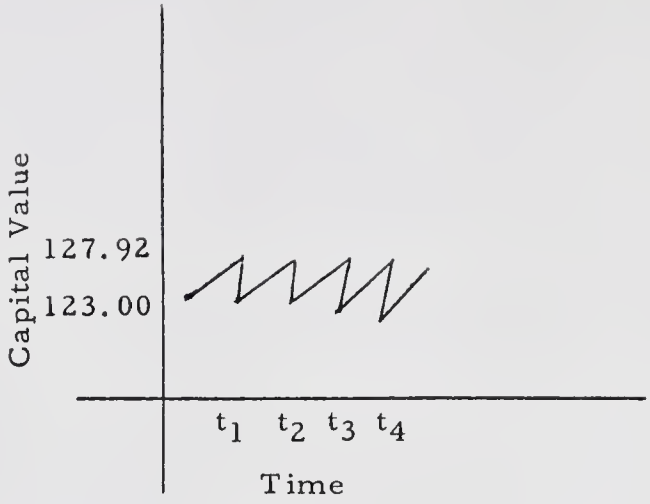

Figure 18

The fall in the capital value is, in all Fisher's diagrams, equal to the income. The magnitude of the receipt is also equal to the income. In this case the fall in capital value is always $4.92 but the receipt is never $4.92. The receipt can be only $3, 4, 5, 6 or 7 by the terms of his own example. There is a contradiction here.

Assume, for example, that the first dividend was $3. The capital at the time of receipt, t_2, is $127.92 and the fall of $3 leaves a capital value of $124.92. But the capitalization of E at t_2 remains at $123.[48] The $1.92 discrepancy is never mentioned

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[48] The fact that one event has occurred does not change the probabilities of future events. The number of times that a coin has turned up heads does not change our estimation of the probability for future flips. If we use the relative frequency as an

by Fisher. He points out that there will be disruptions in the capital-value curve because of changing estimates of the future (p. 320) but in this case our estimate of the future has remained constant and we have an unexplained disruption.

All of the above only serves to emphasize that E is an average value. It is a value that is expected to occur only after an infinite number of trials. The difficulty of discounting an average is that the pattern of receipts is an important factor in the determination of a present value. Lassiter has proved that changes in skewness and kurtosis of a receipt curve will markedly change the yield.[49] Reversing Lassiter's procedure, it is obvious that a constant rate applied to various receipt curves will markedly change the present value. Thus, it is not only the magnitude of E which influences the present value, it is also the pattern over which receipts come in. But even under the simple conditions of risk, we do not know the pattern and therefore we we can not determine the present value.

Moreover, the difference between E and any particular receipt is locked-in the market. The average of the receipts will

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estimation of probability the occurrence of an event will change the probability of future events. If that is the case here the probability of the dividend being $3 is now 2/13 (0.1538) which lowers E and consequently lowers the capitalized value below $123.

[49]Roy Lassiter, "A Note on the Effect of Kurtosis and Skewness on Present Value" (unpublished).

equal E only after an infinite number of trials and therefore the cumulative deviation will remain locked-in until an infinite number of trials has occurred. An infinite number of trials will take an infinite amount of time--in this case an infinite number of years. Any magnitude discounted by any rate is zero if the time period is infinitely long. Thus, regardless of rate selection problems, the deviation has a zero present value.

When we take these factors into account we are required to focus on discounting the next receipt in order to avoid giving a positive value to the deviation. That is, the deviation has a zero present value, but if we discount any magnitude other than the next-receipt we will be giving the deviation a present value other than zero. There is the rub; we do not know what the next-receipt is or even the pattern of receipts; we only know the average after an infinite number of trials. Therefore, we may conclude that E is not useful for valuation purposes.

If we attempt to utilize E in our trader model, the situation becomes absurd. In order for E to be applicable there would have to be an infinite number of exchanges of exactly the same magnitude and the time interval between each exchange would have to be foreknown. There would have to be exchanges in order to detach the income. If there was only growth with no detachments, the discount period would be infinity, resulting in a zero present value. Thus, there must be exchanges. Each exchange (purchase)

must be of exactly the same amount; otherwise the compounding process would require perfect foreknowledge of the exact pattern of the transcos.

Suppose, for example, that the trader wishes to withdraw, detach, $5 per year and an E calculation indicates that on the average he can do this. His rate is (arbitrarily assumed) 5 per cent and thus he is willing to pay $100 for the initial contract. Since E is an average it is almost certain that the completion of the first exchange will yield something different from $105. Let us assume that the first exchange yields $155 of which he withdraws $5. Nothing has changed, neither E nor the rate, so he is still willing to pay $100 for a contract and the present value of that contract is still $100. But what about the other $50? It is not a future receipt, it has no future yield so it need not be discounted. Its value is $50 and it is also money-income. Surely the trader is better off now than before but the value of the future income is still only $100.

The trader may be required to keep the $50 in "reserve" against the day when a particular exchange will lose. If this is the case, he is investing $150 to insure a continuation of a $5 income. But he is unwilling to do that since his rate is 5 per cent. E would have to be $7.50 in order to induce the trader to stay in this market. Therefore, the trader either gets out of the market or lowers his rate.

It may be argued that the reason for this paradox is that

we have mis-stated E in the example. Perhaps it should be stated that "E is equal to $5 per $100 invested." In this case the trader's rate will remain the same and if he starts with only $100, presumably he can withdraw $5 per year. This also leads to absurdity because we have reversed the valuation order. "A $100 investment yields $5 per year" is different from "$5 per year is worth $100 at 5 per cent." That is, the value is the determinant of the income instead of vice versa. There can be no rate other than 5 per cent. If the trader values $5 per year at 4 per cent he is willing to pay $125. But this amount under the assumption, will yield him $6.25, i.e., 5 per cent instead of 4.

It would be tedious to continus this analysis in detail. In the author's opinion, enough has been said to cause us to reject the discounted value of E as a method of valuation. There are plenty of additional problems, e.g., time-interval equivalence, continuous alternative E calculation from the present transco, being forced out of the market by losing all on the first trade even though E was positive, etc. We will leave the details of these and other problems to the interested reader's imagination.

Relaxation of the Risk Assumption.--Under the assumptions set forth above, the enterprise was insurable. Under the more realistic assumption of uncertainty--vice risk, using Knight's distinction--we could not insure because we could not list all the possibilities and, more importantly, the assignation of probabilities is little, if any, more than a guess. There are

no a priori probabilities and there is no reason to assume that relative frequencies are applicable. The probabilities are those that result from someone's feelings. Thus, E is nothing more than a quantification of someone's feelings about the future.

We concluded above that E was not useful for valuation under conditions of risk and we may conclude here that the added complexities of uncertainty add weight to the prior conclusion.

Valuation Dissonance

Another difficulty that arises in The Fisher Tradition is the dissonance of valuation among valuers. That is, assuming away the problems presented above, the difference in expectations and rates between traders would result in identical objects having different values.

If every trader's expectations and rate were exactly the same, the market price would move to equal that expectation and the only gain possible would be pure interest. Obviously this is not the case. As a consequence, we can say, with little fear of distortion, that any two traders in a given market at a given time will have different expectations. Hence, if The Fisher Tradition is used under uncertainty, the value of identical objects in the same spatio-temporal relation will be different.

Moreover, in the commodity market, every "long" would be offset by a "short" with exactly opposite expectations. If we valued each contract by the discounted expectation we would be in

the incongruous position of applying opposite algebraic signs to one object. At interim instants both would show an increase in value--income--when it is certain that one must suffer a loss.

The same is true for trading markets that do not have short contracts. The demand curve describes the range of the purchaser's expectations of a price increase. The supply curve describes the seller's expectations of a decrease in price.[50] Thus for every dollar in the market with a positive expectation there is a dollar with a negative expectation. One expectation must be wrong.

It is difficult to know just what kind of comparison can result when identical objects receive different values at the same time. The comparison cannot be of objects, it must be of valuers. But one cannot compare valuers unless one knows about the objects that they are valuing. Suppose trader A and trader B held identical objects which they valued as $10 and $20 respectively. If the binit

A = $10 worth of wheat

B = $20 worth of wheat

is reported there is not even the possibility of comparing valuers because we do not know that the quantity of the objects held is identical. Trader A may be an optimist with a small quantity

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[50]Or, at least a lower expectation than some other alternative. Only when this is the trader's best-alternative does a sale indicate the expectation of a decline.

and B may be a pessimist with a larger quantity. Thus, unless there is some method of reporting that the objects are identical, the reporting of different values does not even allow a comparison of valuers. We can not say that such a message quantifies the trader's expectation because a discount rate is also involved. Two traders with identical expectations could have different rates and hence, different values. We fail to understand how any meaningful instantaneous comparison can be made under The Fisher Tradition.

If we desire to make inter-temporal comparisons of the same trader we run into similar difficulties. The three variables--expectations, rate and quantity--are still present and any inter-temporal change in value may be caused by any one or combination of the three. That is, if we report an increase in the value of the wheat, there is no way for the receiver to know what caused the change in value. It may be nothing more than that the trader now "feels like 1 per cent" instead of "feeling like 10 per cent."

Equally as much information about expectations is given if we simply report that the trader holds wheat. His position indicates the direction, from the present transco, of his expectations. The value under the Fisher method indicates nothing more than the direction because of the rate variable. Thus, The Fisher Tradition which is based solely on expectations, yields no more information about expectations than the simple report

that "wheat is held."

If the receivers wish to compare the trader's predictions with theirs, another indispensible datum must be transmitted, viz., the present transco. The Fisher value does not indicate the present transco yet the other receivers must know its magnitude before they can predict.

CHAPTER IX

THE ACCOUNTING TRADITION

> Perhaps to some it will appear that certain of the criticisms are picayune and that I have been too severe....No criticism...if correct, is either too picayune or too severe, since it should contribute to the attainment of that perfection to which worthy workmen should aspire.[1]

To describe the Accounting Tradition is much more difficult than it appears. There is a variety of different valuation methods in present-day accounting practice and a variety of reasons given in justification of each method. In addition, there are academic accountants who propose valuation methods that are not accepted in practice.

It would be a happy situation if we could equate "The Accounting Tradition" to the "historical cost" method of valuation and then proceed directly to a discussion of the theory of historical costs. Unfortunately, this is impossible. There is no single theory of historical costs per se. There are many different authors who justify the use of historical costs but they often justify it for different reasons. More importantly, they usually

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[1]George R. Husband, "A Critique of the Revised Statement of Accounting Principles," Accounting Review, XVII (July 1942), p. 293.

justify it by appealing to some more fundamental principle. Therefore, any critique of historical costs would necessarily transform to a discussion of the fundamental principle. But different authors appeal to different principles, and thus our discussion would diffuse into a rather random consideration of various authors and various principles.

Much of the accounting literature is concerned with valuation of specific assets instead of a general theory of valuation. Most textbooks consider the assets seriatim and often insulate the discussion. The result is different valuation methods for different assets. We could find the same author proposing the following:

1. Undiscounted future receipts (Accounts and Notes Receivable).
2. Discounted future receipts (Bonds Receivable).
3. Current market price (Common Stock).
4. Lower of cost or market (Inventories).
5. Unamortized original cost (Organizational Expenses, Land).
6. Amortized original cost (equipment).
7. Market Price at date of acquisition (Donated Assets).
8. Market Price at other dates (Some or all of the assets at time of Quasi-reorganization).
9. Zero (Advertising and Research Costs).

10. Constant (Exchange rate applied to Foreign Subsidiary assets).

This is only a partial list of different valuation methods, but it is sufficient to mitigate against the oversimplified equation of historical costs to the accounting tradition.

Since our model is concerned with a specific asset, it may be thought that we could confine the description of the Accounting Tradition to that asset. We don't do this for two reasons: First, and most importantly, we would like our comments to be directed toward a general theory of valuation instead of quarreling about a specific asset. Thus, in order to make our conclusions more broadly applicable we must discuss "accounting" instead of one asset. Second, there is no single accounting method of valuation for any specific asset. If we examined the literature on one asset, we would find that there were different methods of valuation under different conditions in the same firm.

The second point needs some elaboration. One rather detailed example should suffice. Since there is little literature devoted to commodity contracts, let us consider the various valuation methods of the closest substitute. Stocks and/or bonds which are traded in an almost perfect market may be classified in a variety of ways under different criteria. For example:

Criterion	Classification
1. Managerial intent about ultimate disposition.	(a) Asset or (b) offset to liability

2.	Contractual agreement with trustee.	(a) Asset or (b) offset to liability
3.	Managerial intent about length of time to be held.	(a) Current or (b) fixed.
4.	Type of firm.	(a) Marketable security, (b) inventory or (c) earning asset.
5.	Subsidiary or not.[2]	(a) Temporary or (b) Permanent.

But our troubles have only begun. Any particular classification may have alternative valuation procedures. For example: (3a) may be valued at i, market; ii, lower of cost or

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[2]There is argument about when a firm should be considered a "subsidiary." Some utilize a quantitative criterion and others a control criterion.

> An obviously important issue is the question as to what units in a complex of more or less closely related enterprises should be thus combined for reporting purposes. The general rule is that an affiliate should be consolidated (1) if it is subject to the administrative control of the dominant central interest, and (2) if its operations are an integral part of the economic entity embraced by the statements. Although effective control may be achieved through ownership of less than 50 per cent of the voting stock of a corporation, it is usual practice to consolidate only when more than 50 per cent is owned. Foreign subsidiaries are often excluded, regardless of the percentage of stock ownership, on the grounds that government policies are or may become such as to restrict control. Domestic corporations which are subject to government regulation (finance companies, for example) may likewise be excluded for similar reasons. While it is certainly desirable that consolidated reports disclose the affiliates included and excluded and the reasons for exclusions, it is not universal practice to do so.

Thomas M. Hill and Myron J. Gordon, Accounting: A Management

market; or iii, cost. (5b) may be said to be valued at "cost" but there are alternative sub-procedures under cost, viz., i, "cost"; ii, "modified cost"; and iii, "equity." The equity sub-procedure is essentially one of accruing the earnings of the subsidiary and adding it to the original cost. When the criterion is changed from (5) to (3) however, no such accrual is allowed, albeit both (5b) and(3b) are "permanent investments" under the "fixed" classification. On the other hand, if it is a Bond, the interest must be accrued but there are alternative acceptable methods of accrual (straight-line and annuity).

As this scant analysis shows, it would be tedious to consider all the valuation methods and sub-procedures resulting from the combinations on this list. However, for the reader who is relatively unfamiliar with the literature, it would be illuminating to detail one classification. Therefore, let us restrict our discussion to a common stock held by a mercantile company as a temporary investment.

There are three basically different valuation methods for this classification:

1. Cost
2. Market
3. Lower of cost or market.

Approach, rev. ed. (Homewood, Ill.: Richard D. Irwin, Inc., 1959), p. 287.

Different authors argue for each of these methods on different grounds.

There are several problems in determining the cost of a marketable security which results in some slight variations in the original valuation. For example, certain incidental costs are excluded on a convenience criterion. Major revisions in costing have been suggested--application of cost accounting techniques--without much acceptance. If the securities are not sold as a block, the residual value may be determined by several acceptable sub-procedures:

1. Lifo
2. Fifo
3. Average (Several variations)
4. Specific identification.

"Market" is subject to several interpretations:

1. Replacement cost.
2. Net realizable value (Several variations)
3. Fair market value (Several interpretations of "fair").

The question then arises as to whether the "market" should be applied to individual securities or to the block, and, of course, differences in application result in different values. Some authors suggest that "minor variations" in market should be excluded and only "marked appreciation or depreciation" should occasion a change in value. Others differentiate "temporary"

and "permanent" changes in market and argue that only the permanent type is sufficient reason for a value change.

The "lower" method results in a different value for each combination of the above. That is, "lower" at lifo-block-permanent-minor-incidental-net realizable would be different from fifo-block-etc., and likewise for any other change in the elements.

In addition to these variations in valuation methods, there is disagreement over the effect of a value change on income. Many would exclude a value change from the concept of income altogether. Some take the change directly to "Retained Income" (avoiding the Income Statement), and others would take it to "appraisal capital" or "unrealized surplus." That is, they would change various net worth sub-divisions without changing income. Some differentiate value decreases from value increases and suggest that only decreases should affect income.

A survey of practice reveals a similar situation. Current Accounting Trends and Techniques[3] lists ten categories of "valuation basis used" plus a residual category called "basis of valuation not set forth." They conclude that most companies use "cost" as a valuation basis. However, they put quotation marks around the word, presumably to indicate that there are variations on the cost theme.

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[3]American Institute of Accountants, Accounting Trends and Techniques, 7th ed. (1953).

This example, although not as detailed as it could be, should be sufficient to make our point: There is no single valuation method, even for a specific asset, which we can call "The Accounting Tradition."

In sum, there is a variety of valuation methods in accounting and a variety of reasons for the variations. The valuation method will vary from asset to asset, from condition to condition, from criterion to criterion, from firm to firm, from practitioner to practitioner, from author to author and in a kaleidoscopic combination of these factors. In addition, as we reviewed the literature, we were struck by the lack of any genuine theoretical analysis of the variations. We join Mr. Spacek's lament:

> Instead of standards of measurement, attention is focused on techniques. Most documents are overburdened with procedural comment on how to handle certain transactions, but little is said about the effect sought, and still more important--why.[4]

Often the reasons given in justification of a proposed valuation method are cursory and cryptic, with the majority of the space and effort devoted to lengthy descriptions of technique.

We think that such a condition has a very simple explanation: There is no adequate, explicit accounting theory in existence. The valuation variations per se are evidence for this

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[4]Leonard Spacek, "The Need for an Accounting Court," Accounting Review, XXXIII, No. 3 (July 1958), p. 369.

thesis. The dearth of theoretical analysis is further evidence. As might be expected, we have been unable to locate any single theory of accounting which synthesizes all these views into one tradition.

For this reason, we must alter our methodology at this point. In the last two chapters, we outlined and discussed a personified theory from essentially a single source. Here we are without a universally accepted spokesman and, therefore, cannot follow that methodology. We have two lines open to us:

1. A seriatim examination of selected theories and theorists.
2. A presentation of our own hypothesis about the Accounting Tradition.

Both are fraught with difficulties. Because of space limitations, we would be forced to select from a multitude of theorists if we followed the first line. This would leave us open to the charge of omitting someone's favorite theorist and/or theory. In addition, because of the literature's emphasis on technique at the expense of theory, we would be forced to hypothesize about each author. Their many cryptic statements are not amenable to analysis in their present form, and thus we would have to present and criticize several alternative interpretations. If we follow the second line, we are in the peculiar position of being both the originator and the critic of a line of thought. We would be forced to abstract a theory from a number of diverse

theorists. Like all generalizations such an abstraction would be false. The degree of falseness would vary from theorist to theorist, but no theorist would be described with complete accuracy.

Recognizing the limitations we will follow a combination of the two lines. First, we will abstract what we consider to be the de facto accounting tradition. We will put forward the hypothesis that there is a central principle that explains the mainstream of accounting thought and practice. Second, we will critically examine some specific rules of valuation. We will show that these rules must originate in the central principle since they cannot stand alone.

Our fundamental thesis is that accounting theory has been an amalgamation of cognitively insulated rules of valuation. Ladd speaks of it as expedients:

> The development and regulation of accounting theory and practice is basically the result of ad hoc expedients, largely dictated by the very corporations whose affairs are being accounted for.[5]

We will attempt to explain the result of these expedients and the tenuous thread that links them.

Such an hypothesis necessarily involves some conjecture. An abstraction of this kind is not subject to conclusive proof,

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[5]Dwight R. Ladd, Contemporary Corporate Accounting and the Public (Homewood, Ill.: Richard D. Irwin, Inc., 1963), p. 160.

instead it is the result of fragmentary evidence coupled with an intuitive leap. Also, it will not serve as a complete explanation of every author or every valuation method. It is intended to be an explanation of the mainstream of accounting thought and the de facto practice of accounting. Thus, it will exclude people who call themselves accountants, but who, from our point of view, are either on the fringes or in another tradition.

Another reason for excluding the fringe group is their lack of impact on the practice of accounting and the textbook literature. Canning, for example, has had little influence and we would classify him mainly in the Fisher Tradition.[6] MacNeal plumps for current market values and has been ignored.[7] Moonitz is more difficult to classify and, since his most revolutionary work is very recent, the impact is unknown. We exclude these people and others like them from what we consider to be the Accounting Tradition.

The "mainstream of thought" is usually rather accurately mirrored by textbooks. In addition, the impact of a successful text is infinitely greater than an academic treatise if for no other reason than that it is read by more people. Thus, much of our evidence is from popular texts.

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[6]John B. Canning, The Economics of Accountancy (New York: Ronald Press Co., 1929).

[7]Kenneth MacNeal, Truth in Accounting (Philadelphia: University of Pennsylvania Press, 1939).

After presenting our hypothesis, we will examine the valuation rules that are most germane to our study. Many accountants will agree on the rules but disagree on the reasons. Space and time limitations present us with a selection problem. Our general criteria of selection will be:

1. Impact on the profession.
2. Degree of deviation from the mainstream.
3. Their direct consideration of the rule under discussion.

For example, we select a quotation from Finney because:

1. His texts have been the most widely used in this country for over twenty years. He set the style and has been widely emulated. Probably more accountants have read Finney than any other single book.
2. He is not only squarely in the mainstream, he is a major cause of the direction of the mainstream.
3. His reasoning is particularly germane because we have the same starting point, i.e., he reasons from the problem of valuing a marketable security to a general conclusion.

Likewise, May, Paton and Littleton are considered because of their impact. They are all "grand old men" of accounting. Many others with different--perhaps better--reasons have been omitted.

The Fundamental Principle of Valuation

Accounting has always been a highly practical discipline. Accountants have been faced with the problem of making immediate decisions in order to meet the exigencies of practice. They have not had the luxury of unlimited reflection before taking a position. In addition, they were not much more than specialized craftsmen when an almost overwhelming responsibility was rather suddenly thrust upon them. They were asked to become the stewards of the communities' wealth in a period of financial piracy. They were required to have integrity when deceit was the order of the day.

As a consequence of these factors, there were twin developments:

1. Problems were solved in isolation.
2. The solutions became accepted and rather rigid.

The accountants met problems and solved them on the basis of their best judgment about the particulars of that specific problem. Very likely the cognation was completely insulated from a similar problem that they had previously solved. The resulting cognitive dissonance probably did not bother the accountant because his main concern was with the ethical effects of his decision. Meanwhile, another practitioner in another firm was solving a problem that was only slightly different and often coming up with

a vastly different answer. Thus, there developed intra- and inter-practitioner inconsistencies. At the same time, the accountant needed a strong defense against the sometimes simply optimistic, often dishonest, financiers. He was placed in the precarious position of being subject to the pecuniary discretion of the person he was obliged to keep honest. In the absence of a cohesive theory, in the absence of police power, in the presence of ignorance and apathy of the community, his only defense was precedent and persuasion. Precedent soon became rule and the rigid application of rules was his only weapon in the face of a powerful adversary.

The accountant passed through the era of swash-buckling manipulation; the era of watered stock and financial bubbles; in short, the era of chicanery by financial overstatement. In addition, he has always been faced with the effervescent optimism of the entrepreneur. The entrepreneur is naturally optimistic about his project. If he were not, he would not be engaged in it. This optimism is evidenced by a tendency to overvalue the enterprise. Faced with the universal tendency to overstate, the accountant conceived his role to be one of temperance. As a steward, he needed to be the ultimate in solidarity and stability. He wanted to insure that the value was <u>at least</u> the amount he reported. Often, to combat overstatement, he proposed understatement, perhaps

with the hope of striking a balance.[8]

Thus, the most ancient and probably the most pervasive rule of valuation is "conservatism." Recently this rule has come under attack. Many people have pointed out that deliberate understatement is equivalent to deliberate misrepresentation and have urged that the accountants' function was "to tell the truth." Finney, who usually mirrors the mainstream of accounting thought, referred to conservatism as a "principle of accounting" through four editions. In the fifth edition, however, he complains about the "fetish of conservatism."

We recognize that conservatism has lost favor in accounting circles, that it is not applied in practice as much as it once was, and that the academics challenge it. Nevertheless, the author considers conservatism to be the most influential principle of valuation in accounting. Other principles, e.g., cost, consistency, realization, going concern, etc., are often given higher (always equal) status. We regard such lists as erroneous and consider conservatism to be a much more fundamental and pervasive principle than the others usually listed.

Evidence for this assertion is mainly operational. Accountants violate the historical cost principle when they value at the

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[8]It is interesting that one of the consequences of the Federal Income Tax has been a tendency to reverse the roles. The accountant has had to resist the entrepreneur's desire to avoid taxes by financial understatement.

lower of cost or market. The realization convention is violated in the case of installment sales and the write-down of obsolete inventory. The going concern assumption is abrogated when it results in a value greater than market. If the consistent application of a valuation rule becomes unconservative, accountants usually become inconsistent. The basic "benefit theory" is violated in favor of conservatism in several instances, e.g., advertising and research expenditures.

In addition to these examples, evidence comes from justifications presented in the literature. Many authors take a "moderately conservative" or even "anti-conservative" position when they are writing under the head of "Principles." However, when they are discussing the valuation of a specific asset, the recurrent phrase that something "is or is not conservative" is almost inevitable.

For example, Johnson and Kreigman take an "anti-ultra-conservative" view in their chapter on "Accounting Theory."

> Misrepresentation was often injected in the balance sheets of businesses by policies involving the deliberate understatement of asset values in order to achieve so-called "conservative" values for these assets...By these practices, "conservative" values became "ultra-conservative" values not fairly presenting the net income and financial position of a given business.[9]

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[9]A. W. Johnson & O. M. Kriegman, Intermediate Accounting, 3rd ed. (New York: Holt, Rinehart and Winston, 1964), p. 740.

The tone is clearly anti-ultraconservative. Perhaps it is anti-conservative when we juxtapose a statement from an earlier discussion of principles.

> The statement of income and the balance sheet, therefore, must be built upon the cornerstone of truth.[10]

Yet when they discuss the valuation of stocks, they write:

> The valuation at current market of stocks and bonds held for short-term investment purposes, when market is higher than cost, is a practice not generally approved by accountants. This disapproval rests on the fact that the practice not only involves a departure from original cost as the time-honored yardstick of accounting valuation but also involves accounting recognition of appreciated values. The practice is obviously not conservative; and accountants generally have been loathe to place an unrealized surplus account on the balance sheet. What support has been given the practice has been defended on the grounds of showing the financial position of the business on a realistic basis.[11]

It is not clear whether these are the authors' arguments or whether they are reporting the predominant view of the profession. Either case supports our point.

The above quotation sets out two conflicting concepts: Conservatism versus realism. Without further argument, the above quote is the entire discussion of the pros and cons of market valuation of securities, they draw a conclusion. They point out

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[10] Ibid., p. 5.

[11] Ibid., p. 129, emphasis supplied.

that valuation at market "is not generally approved" by the accounting profession and then they support a cost valuation.

> The authors believe that profits and losses on marketable securities should be recognized only at the date of their sale. On the balance sheet, marketable securities should be valued at cost.[12]

Obviously, "conservatism" takes precedence over "realism" for both the profession at large and these authors. We suspect that the authors would abandon their strict cost position in a period of deflation.

Moreover, they state explicitly the connection of the realization convention to conservatism.

> Today, the doctrine of conservatism is essentially a policy of caution. Revenue, for example, will receive accounting recognition only after it has been realized...[13]

That is, the realization convention has its roots in the principle of conservatism.

Another widely used text supports this thesis:

> The doctrine of conservatism is illustrated in the application of practices such as the following: increases in the values of assets and anticipated gains are normally ignored until realized by means of sale; declines in asset values and anticipated losses, however, are normally recognized....certain expenditures are charged in full against current revenue despite the

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[12] Ibid.

[13] Ibid., p. 740.

> possibility of future benefits.[14]

This text then takes a moderately conservative position:

> A conservative approach in the measurement process is desirable.[15]

Later, the arguments for valuation at market are briefly surveyed and then rejected. The reasons for the rejection in their entirety follow:

> Little tendency to accept valuation at market has been shown by the accounting profession. Such procedure has been challenged chiefly on the grounds that it represents a departure from the cost concept and would violate accounting conservatism.[16]

In view of their previous statement which justifies departure from the cost concept in favor of conservatism, we could infer that the violation of accounting conservatism is the fundamental argument against valuation at market.

One additional reason for the thesis--conservatism is the fundamental principle--is the odd character of the attacks on it. Much of the literature opposes conservatism because it is not conservative! A common argument against conservatism in one period is that it produces unconservative values in another period. Paton argues that "cost or market is not truly conservative"

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[14]H. Simons & W. E. Karrenbrock, Intermediate Accounting, 4th ed. (Cincinnati: South-Western Publishing Co., 1964), p. 49.

[15]Ibid.

[16]Ibid., p. 248, emphasis supplied.

because:

> A low inventory at the end of one year is reflected in the cost of sales of the ensuing period, and as a result the income of the second period is increased (or the loss reduced) by precisely the amount by which the opening inventory was reduced through the operation of the "conservative" rule.[17]

That is, intertemporally, an apparently conservative procedure is not "truly conservative."

A slight variation of this argument is presented in an official pronouncement of the AICPA:

> The argument advanced in favor of immediately writing off discount was that it extinguished an asset that was only nominal in character and that it resulted in a conservative balance sheet. The weight attached to this argument has steadily diminished, and increasing weight has been given to the arguments that all such charges should be reflected under the proper head in the income account, and that conservatism in the balance sheet is of dubious value if attained at the expense of a lack of conservatism in the income account, which is far more significant.[18]

A little license in paraphrasing yields:

> The income statement is now thought to be more important than the balance sheet, and, therefore, the principle of conservatism should be more rigorously applied to the income statement.

That is, the fundamental principle is conservatism and, therefore,

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[17]W. A. Paton & W. A. Paton, Jr., Asset Accounting (New York: Macmillan Co., 1952), p. 84.

[18]American Institute of Certified Public Accountants, Accounting Research Terminology Bulletins, final edition (New York: AICPA, 1961), p. 129.

a conservative value on the more important statement is more desirable than a conservative value on a less important statement.

In sum, our primary hypothesis is:

> Conservatism is the fundamental principal of valuation in the Accounting Tradition.

The reasons for this thesis are:

1. The development of accounting has a natural tendency toward conservatism.
2. There are many instances when other principles are violated in favor of conservatism.
3. Many accountants who deny conservatism continue to use it as a justification for specific practices.
4. One argument against conservatism is that it is not conservative.

Our secondary thesis is:

> Conservatism is the premise, often tacit, from which other rules of valuation are derived.

There is some support for our secondary thesis in the accounting literature. We indicated some examples above. Some authors freely admit that certain valuation rules are applications of the conservative principle. These are usually the authors with a "liberal" bent and they are support for our thesis. Other authors, the most conservative, in fact, if not in statement, strain to justify valuation rules on grounds other than conservatism. We think that such straining and the resulting invalidity of

the arguments is evidence of their tacit premise of conservatism. An examination of representative arguments of this type is the task of the next section.

We should not leave this section without indicating that we think there are principles of valuation other than conservatism. The author has a manuscript in progress in which the thesis is presented that there are three fundamental principles of valuation, viz., conservatism, convenience, and causality, and their influence is in that order.

Briefly, the notion of convenience is that throughout the history of accounting there has been an unyielding pressure to get some statistic out in the shortest possible time, at the lowest possible cost, with the least chance of being challenged. This has resulted in valuation rules which are convenient. For example, "cost" is a readily available statistic; "realization at point of sale" is a fairly clean-cut, easy-to-apply rule; "materiality" is a justification for breaking the rules if it is much more convenient to do so.

The third principle--causality--is a relatively recent addition coming from academics who attempted to apply causal reasoning to the existing accounting practices. Cost accountants were in the forefront of this process arguing that cost should be attached to the unit that caused the cost to be incurred. They became involved in long arguments over the allocation of overhead, culminating in the recent controversy over "direct costing,"

i.e., charging to units only the incremental costs that were caused by the incremental units. Other examples are the "benefit theory" which charges costs to the period which they benefit, i.e., periods in which those costs cause revenue. The whole of the "matching" and "attaching" concepts spring directly from causality arguments.

We think that these three principles, singularly or in mixed weight combinations, serve to explain all that accountants do and most of what they say. However, the last two principles are not as germane to this study as the first. For this reason, only the first was developed.

The Fundamental Rule of Valuation

In the previous section, we put forth the hypothesis that "conservatism" is the fundamental principle of valuation in the Accounting Tradition. The most widely accepted rule of valuation is that of "historical cost." As we have previously pointed out, "cost" has many variations in application and thus it is difficult to analyze the rule in the abstract.

We think that the explanation for the variations is contained in our hypothesis. Cost is not a fundamental tenet of accounting: instead it is a derivative of the principle of valuation. First, and most importantly, the rule almost always yields a conservative value. Cost, particularly in assets which have been amortized, i.e., valued below cost, is virtually certain to be considerably

below market. As we have seen, when the cost rule is not conservative, it is violated. Second, cost figures are usually far more convenient to obtain than any other value. Ordinarily there is easy access to documents--invoices, checks--which yield "a" cost of an item.[19] Occasionally, there is some difficulty in obtaining the cost figures and the accountant reverts to conservatism by making a rather low estimate or, if the amount is "immaterial," by assigning a zero value. Third, costs are attached to products or periods by some causally derived rules. Some costs "benefit future periods"--cause revenue in the future--and the value is maintained on the books. Other costs have "benefited past periods"--caused past revenue--and are valued at zero. If a cost produces a product which is "expected to benefit future periods," the cost attaches to the product until it is sold (causes revenue). If the product "loses utility" (loses part of its capability to cause revenue) there is a reversion to conservatism as it is written down. Of course, values other than cost could "attach" so that causality is not a necessary principle for the cost rule.

In short, cost is both conservative and convenient, and thus it fits our general hypothesis. Our secondary hypothesis--that cost is a derivative of the general principle of conservatism--

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[19]We say a cost instead of the cost because of the previously noted difficulties in "capital versus expense." As several people have pointed out, ten different accountants are likely to get twelve different costs. Cf. Charles T. Horngren, Cost Accounting: A Managerial Emphasis (Englewood Cliffs: Prentice-Hall, Inc., 1963), p. 315.

is supported by the fact that when cost and conservatism conflict, conservatism prevalis.

Additional evidence, albeit indirect, for both hypotheses is the manifestly specious character of the arguments for the cost rule. Several arguments will be presented below and then will be shown to be invalid and often absurd. We think that the explanation for this is that the arguments are essentially apologetics for accounting practice. The practice is governed by conservatism, but the authors deny the principle of conservatism and thus are left in the untenable position of defending what they deny. As a consequence, the arguments become strained in attempting to defend the rule.

The Cost Rule

There is some disagreement on the proper term to be applied to the cost rule. Some authors refer to it as a "convention," others as a "concept" and still others as a "principle."

Tunick and Saxe in a chapter entitled, "An Integrated Summary of Accounting Theory" break "principles" down into three categories:

> ..."principles" is in reality a combination of the following related elements: (1) accounting conventions, or postulated basic conditions and assumptions, accepted as such by common consent; (2) accounting standards, or systematic and impartial measures, based on observable, objective conditions, against which conduct and practice must be squared, not as absolute measures, but rather as a safeguard against

> irresponsible action; and (3) doctrines concerning the proper reporting of accounting data, which have received general acceptance.[20]

Then in a "brief, formal restatement" of the principles under the heading of "Accounting Conventions" and the sub-heading of "The Valuation Convention," they write:

> Money is accepted as a stable measuring unit, and original recorded cost as the quantitative basis for accounting valuations....Thus far, the valuation convention has been reiterated as a guiding principle by all professional agencies which have re-examined it...[21]

On the following page, they list "cost" as the first sub-heading under "Accounting Standards."[22] For these authors it appears that "cost" is a "principle," a "convention," and a "standard" all at the same time.

Paton and Littleton distinguish between "concepts" and "standards." In a discussion of the former, they employ the term "price-aggregates" as a substitute for "cost" and state that it is one of the basic "concepts" of accounting.[23] Later they devote an entire chapter to the "concept" of "cost."[24]

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[20]Stanley Tunick and Emanuel Saxe, Fundamental Accounting, 3rd ed. (New Jersey: Prentice-Hall, Inc., 1963), pp. 618-619.

[21]Ibid., p. 620.

[22]Ibid., p. 621.

[23]W. A. Paton and A. C. Littleton, An Introduction to Corporate Accounting Standards (Ann Arbor, Mich.: Edwards Brothers, Inc., 1957), pp. 11-13.

[24]Ibid., Chapter III, "Cost," p. 24.

Finney refers to "The Cost Principle" and says it

> ...may be stated as follows: Subject to generally recognized exceptions, cost is the proper basis of accounting for assets and expenses, and accounting records should reflect acquisition costs and the transformation, flow, and expiration of these costs.[25]

Apart from any difficulties in classification, these examples give ample evidence of the importance and pervasiveness of the cost rule in the Accounting Tradition.

Stated in its simplest form, the cost rule is:

> Assets are to be valued at the same magnitude as the assets that were sacrificed in order to obtain them.

This is an exchange rule which makes the implicit assumption that the value of the sacrificed asset is correct. It also assumes that the exchange is an even transaction with neither gain nor loss in value. This presents no problem if one recognized that accountants are normally thinking of cash as the sacrificed asset.

> In cash transactions cost is measured by the amount of the immediate cash consideration; in credit transactions cost is the amount of money which would be required to effect immediate settlement of the obligation incurred. If the consideration is in the form of property or securities of uncertain value, the basis of measurement is the estimated cash equivalent

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[25]H. A. Finney and Herbert Miller, Principles of Accounting Intermediate, 4th ed. (New York: Prentice-Hall, Inc., 1953), p. 120.

of the medium employed.[26]

That is, the value received is equal to the value (of cash) sacrificed. The difficulty with such an equation is that it does not allow for value changes. The strict application of such a rule would maintain a constant value regardless of the form of the asset or the number of exchanges.

Recognizing the need for value changes, accountants have adopted rules which permit exceptions to the strict application of the cost rule. These rules take two divergent lines:

1. Value decrements are justified on grounds of conservatism and causality. When costs no longer "benefit the future" or when they "lose utility" they are written off. In the main, conservatism is the guide. (Other values could benefit the future). Decrements based on conservatism are the source of the exceptions that Finney spoke of above.[27]

2. Value increments are restricted, in the main, to exchanges when the received asset is cash or near cash.

We have adequately discussed the first exception above and will neglect any further consideration.

The latter--value increments--is classified as a separate "principle," "convention," etc., viz., the "realization convention." It provides a means for breaking out of the cost equation by valuing

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[26]Paton and Littleton, An Introduction to Corporate Accounting Standards, p. 24, emphasis supplied.

[27]"Downward revisions in the valuation of inventories and marketable securities are accepted departures from the cost basis to a going concern basis, justified for reasons of balance sheet conservatism." Finney and Miller, Principles of Accounting Intermediate, 4th ed., p. 120.

the received asset independently of the previously recorded value of the sacrificed asset. The conception of this rule is also in terms of cash exchanges:

> Revenue is the product of the enterprise, measured by the amount of new assets received from customers;...revenue is realized by conversion of product into cash or other valid assets...for most enterprises the value of sales furnishes the most satisfactory measure of realized revenue... with sale, product is converted into new, measurable assets, cash or receivables ("cash in process").[28]

Thus, there are three elements in "the cost rule":

1. Non-cash assets are originally valued at the cash sacrificed in exchange.

2. Non-cash assets receive value decrements from specific conservative-causal rules.

3. Cash and near-cash is valued at unity.

These can be considered as two separate one-way rules. Cost is the rule for acquisition of non-cash assets. Realization is the rule for acquisition of cash assets.

Reflection on the complete cost rule yields two basis elements in the Accounting Tradition of valuation:

1. The timing of valuation for increases is determined by the exchange.

2. The magnitude of the valuation is determined by the cash exchanged.

The first violates the informational purpose of valuation. It denies the problem of this study by reverting to the completed

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[28]Paton and Littleton, Standards, p. 46, emphasis supplied.

exchange timing of valuation. Only if no information is desired prior to the completion of the exchange is this method of valuation acceptable. It often appears that the exchange is more basic to the tradition than cash.[29]

The second element is a reversion to the much maligned "cash basis of accounting." If the rule were strictly applied, income would simply be the difference between the receipts and disbursements of cash. It is not strictly applied however and the

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[29]Several years ago a debate occurred which evidences the oneness of this rule. Some accountants interpreted "original" in "original cost" as "aboriginal." They questioned the propriety of valuing assets at the amount of cash given in exchange because this cash had been received from sales, and thus was more than the aboriginal cost.

For example,

1. Start with $10.00.
2. Buy merchandise for $10 and value it at $10.
3. Sell merchandise for $15.
4. Use the $15 to buy equipment.

If the equipment is valued at $15, the cost rule is violated because the original cost was $10. Finney outlines the argument and refers to it as a "highly theoretical controversy." (Intermediate, p. 120).

The proponents lost, but vestiges of this argument still creep in when there are trade-ins. Some still argue that an asset acquired on a trade-in should be valued at the original unexpired cost of the asset given up. However, most accountants now agree that the "fair market value" of the asset is the proper basis for valuation. Some still quarrel over whether the fair market value should be of the received asset or the one given up.

The cash-basis valuation has been violated in this specific instance and market price became the final arbiter. However, the exchange requirement is still stubbornly defended. A gain on this type of exchange is considered income.

A violation of both the cash and exchange requirement occurs when an asset is donated or when there is "discovery (of minerals) value." Without the exchange, however, the value increment is not considered to be income. Thus, it appears that the exchange requirement is the more fundamental in valuation for income purposes.

result is the celebrated "accrual-basis of accounting."

Generally speaking, the accrual-basis provides for specified exceptions to the cash-basis. The exceptions are:

1. Value increments may be recorded by the receipt of near-cash or occasionally by cash-equivalents of the asset sacrificed at the time of exchange.

2. Value decrements may be recorded by adherence to individually specified conservative, causal and convenient rules.

As we see it, this is but one minuscle step removed from the cash-basis. Certainly value increments are very close to the cash-basis. Value seldom "accrues" (accumulates) in accounting; it almost always "occurs" by the receipt of cash or contractual obligations for cash. On the decrement side, there are methods of amortization (spreading the cash outlay over time) but it seems odd to speak of "decrements accumulating." Thus, we think "accrual-basis" is misleading. Perhaps "modified cash-basis" or "exchange-amortization-basis" would be more descriptive.[30]

Whatever the title, we have described the fundamental rule of valuation by combining several lesser rules and their exceptions. Applying it to our model the single rule is:[31]

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[30]We are very lonely in this position. Corbin is one of the few who would agree:

> Thus it may be concluded that the accountants' concept of income--realized revenues minus incurred expenses, using accrual accounting to implement the matching process--is in reality simply a modified cash basis of accounting.

Donald A. Corbin, Accounting and Economic Decisions (New York: Dodd Mead and Company, 1964), p. 231.

[31]We simplify by neglecting to state the variations such as market

> Wheat shall be valued at the amount of cash given in exchange. Cash shall be valued at unity.

The arguments in the literature are often classified separately. However, they usually give almost identical justifications for both "historical cost" and the "realization convention." For this reason, and also because we conceive it to be a single rule with exceptions, we will not follow the usual classification system in the following analysis of arguments.

Arguments for the Cost Rule

For our purposes it will be convenient to distinguish two broad categories of arguments for the cost rule. The distinguishing factor is the temporal location of the valuation:

1. The time of acquisition. (Initial valuation)
2. Times subsequent to acquisition. (Subsequent valuation)

Initial valuation by the sacrificed valuing agent agrees with our general notions about the ordinal measurement of value that we presented above. We usually find ourself in disagreement with the arguments but, since the conclusions are identical, we omit the criticism.[32]

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when lower than cost and the lifo-fifo problems when only portions are sold.

[32]For a striking exception cf. Russell Bowers, "Tests of Income Realization," Accounting Review, XVI, No. 2 (June 1941), p. 142. We are in complete accord with Mr. Bowers' analysis as well as his conclusion on the problems of initial valuation.

Our quarrel is with the latter. Subsequent valuation at historical cost is a past sacrifice which is irrelevant to the present valuation. We will analyze only those arguments which are most akin to this quarrel.

Finney's Argument

Finney begins his argument with reference to marketable securities and specifically raises the question of subsequent valuation in terms of "revenue realization." Essentially the question is "Should securities be valued at original cost or at present market?" There are some accountants who would value at present market but would not allow the value increment to affect income. Finney does not make the distinction. He is concerned with both valuation and income at the same time.

His argument has appeared in his texts and in learned journals. For ease of reference, we present it in its entirety with marginal classifications.

(Question) Is unrealized appreciation revenue? Let us consider this question first with respect to marketable securities, as to which it is possible to make the strongest case for an

(Example) affirmative answer. If marketable securities were purchased for $50,000, were worth $60,000 at the end of the year of purchase, and were sold for $70,000 in the following year, was there a $20,000 profit in the second year or a $10,000 profit in each year? While it possibly may be said that $10,000 of the profit accrued each year, and while it certainly can be said that a $10,000 profit could have been realized the first year, it nevertheless is true that realization did not occur until the second year.

(Principle, Premise) The requirements of the accounting principle relative to revenue realization were not met during the first year because, when the management elected not to sell at the end of the first year but preferred to take the hazards of market fluctuation, there was no realization

(Conclusion) of profit nor any reasonable assurance that a profit would be realized.

(Generalization) If readily marketable securities cannot properly be valued at a price in excess of cost, although a profit could be immediately realized by a sale at the market price, the valuation of inventories at market prices in excess of cost is, under ordinary conditions, even less proper.[33]

In order to understand the argument we must reproduce the principle:

> The governing accounting principle is: Revenue should not be regarded as earned until an asset increment has been realized or until its realization is reasonably assured.[34]

Before we can utilize the principle, we need definitions for revenue, earned and realized.

> Revenue consists of an inflow of assets, in the form of cash, receivables, or other property, from customers and clients, and is related to the disposal of product in the form of goods or to the rendering of services.[35]

"Consists" and "related to" are not sharp words, but the meaning is clear:

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[33]H. A. Finney, "Principles and Conventions," Accounting Review, XIX, No. 4 (October 1944), pp. 365-366, emphasis supplied.

[34]Ibid., p. 364, emphasis supplied.

[35]Ibid., p. 363, emphasis supplied.

Definition 1. Revenue is the receipt of cash or near-cash from sales.

"Realized" in the Fisher Tradition is unequivocably the receipt of cash. However, when the Accounting Tradition modified the cash basis, but retained the terms, some confusion resulted. Finney says:

> Realization of revenue does not necessarily require a collection in cash, since a valid receivable from a solvent debtor is an asset in as good standing as cash. The point of sale, therefore, is the step in the series of activities at which the revenue generally is regarded as realized. This point has been generally adopted because (1) it is the point at which a conversion takes place--an exchange of one asset for another--and conversion is regarded as evidence of realization; and (2) it is the point at which the amount of the revenue is objectively determinable from the sale price acceptable to both parties.[36]

Realization is concerned with the occurrence of an act--a sale--and with the form of assets--near-cash--that can be included as "realized." It is a trifle obscure in light of the phrase about "conversion being evidence of realization" because realization is defined as occurring at conversion. Nevertheless, in view of the rest of the literature and Finney's other works,[37] we can define

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[36] Ibid.

[37] Finney's latest edition of the introductory book answers the question in slightly more direct fashion.

> When is revenue earned? Revenue is earned when goods are disposed of or when services are rendered. A transfer or exchange occurs. The business gives up goods or renders services and acquires other

it explicitly:

> Definition 2. Realization occurs when cash or near-cash is received from sales.

Earned is simply a synonym.

> As used in accounting, however, "earned" and "realized" are generally regarded as synonymous.[38]

Again "generally regarded" prohibits sharpness, but in light of the above footnote the definition is clear:

> Definition 3. Earned equals realized.

Since one cannot have receipts-from-sales without the occurrence of a sale, it appears that revenue is the more general term. Substitution of "revenue" for "realization" in Definition 2 does not distort the meaning:

> Definition 2: [Revenue] occurs when cash or near-cash is received from sales.

Revenue is defined as receipts-from-sales, therefore revenue occurs when the sale is made. There can be no lapse of time as there might be on a cash basis because receivables are included in the "realization." Thus, "revenue" and "realization" are

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> assets in exchange. There is a performance accompanied by a concurrent acquisition of an asset.

H. A. Finney and H. Miller, Principles of Accounting, Introductory, 6th ed. (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963), p. 241. As we note in the body above, Finney equates earnings with realization.

[38] H. A. Finney, "Principles and Conventions," p. 363.

synonyms and "realized revenue" is redundant. Receipts-from-sales is the basic concept. At the very most, the distinction is that realization refers to the timing of the receipt while revenue refers to the receipt (inflow) per se. With very little, if any, distortion the general definition may be stated as:

Receipts-from-sales = revenue
= realization
= earnings
= realized revenue
= earned revenue

We can now restate and understand the governing principle:

> The governing accounting principle is: [Receipts-from-sales] should not be regarded as [receipts-from-sales] until an asset increment has been [received-from-sales] or until its [receipt-from-sales] is reasonably assured.

A "principle" of this kind needs no commentary.

We can now restate his argument.

> Is [not-receipts-from-sales] [receipts-from-sales]? While it possibly may be said that $10,000 of the profit accrued each year, and while it certainly can be said that a $10,000 profit could have been [received-from-sales] the first year, it nevertheless is true that [receipts-from-sales] did not occur until the second year.
>
> The requirements of the accounting principle relative to [receipts-from-sales] [receipts-from-sales] were not met during the first year because, when the management elected not to sell at the end of the first year but preferred to take the hazards of market fluctuation, there was no [receipts-from-sales] nor any reasonable assurance that a profit would be [received-from-sales].

No one would deny that "realization did not occur." By assumption,

no sale was made and by definition, realization occurs at sale. His conclusion is of the same order. In effect he says "when management elected not to sell there was no sale;" i.e., "when there was no sale there was no sale." A more exquisite example of petittio principia is impossible to imagine.

Two minor points remain. First, the tense of the last statement is important. "No reasonable assurance that a profit would be realized." Finney is concerned with the future, with the ultimate profit realized from sale, not with the measurement of past events. He says "it certainly can be said that a $10,000 profit could have been realized." He does not deny that he could measure the amount that "could have been realized" but, since there is no reason to think that this is the amount that will ultimately be realized, he is not interested in valuation before the exchange is complete.

Second, the word "certainly" implies sureness of the amount that "could have been realized." Could this be interpreted as admission of an "objective" measurement prior to sale? His second justification of realization is that the sale "is the point at which the amount...is objectively determinable..." not is more objective, yet he seems to imply that there may be other points when the amount is objective. Both of these points will come up again below.

Finney's argument must be rejected as circular, repetitious and ambiguous. Many explanations for his circularity could

be advanced, but, in light of the fact that he has sold over a million copies to a rather conservative audience, we prefer the hypothesis of a tacit assumption of conservatism.

May's Assumption and Argument

Mr. May's argument is presented in an AICPA sanctioned study because it is "pertinent for the light it throws on the reasoning behind this guide [realization convention]."[39] We consider it for the same reason and, also, because Mr. May is a very well-known and highly-respected accountant who has had great influence on the profession.

> The problem of allocation of income to particular short periods obviously offers great difficulty--indeed, it is the point at which conventional treatment becomes indispensable, and it must be recognized that some conventions are scarcely in harmony with the facts.
>
> Manifestly, when a laborious process of manufacture and sale culminates in the delivery of the product at a profit, that profit is not attributable, except conventionally, to the moment when the sale or delivery occurred. The accounting convention which makes such an attribution is justified only by its demonstrated practical utility.
>
> It is instructive to consider how it happens that a rule which is violative of fact produces results that are practically useful and reliable. The explanation is that in the normal business there are at any one moment transactions at every

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[39]Robert T. Sprouse and Maurice Moonitz, "A Tentative Set of Broad Accounting Principles for Business Enterprises," Accounting Research Study, No. 3 (New York: American Institute of Certified Public Accountants, 1962), p. 13.

> stage of the production of profit, from beginning to end. If the distribution were exactly uniform, an allocation of income according to the proportion of completion of each unit would produce the same result as the attribution of the entire profit to a single stage.
>
> A number of conclusions immediately suggest themselves: first, that the convention is valid for the greatest variety of purposes where the flow of product is most uniform; second, that it is likely to be more generally valid for a longer than for a shorter period; and third, that its applicability is seriously open to question for some purposes where the final consummation is irregular in time and in amount. Thus, the rule is almost completely valid in regard to a business which is turning out a standard product in relatively small units at a reasonably stable rate of production. It is less generally valid--or, to put it otherwise, the figure of profit reached is less generally significant--in the case of a company engaged in building large units, such as battleships, or carrying out construction contracts.
>
> These considerations throw a useful light on the problem of the changing uses of accounts; they also explain a tendency which has been notable during the last fifty years in the accounting treatment of large contracts and similar enterprises. In earlier days, when the use of accounts as an indication of earning capacity was not considered, and when conservatism was clearly a virtue, the procedure of treating the gain on even a large contract as arising at the moment of its completion was unobjectionable--any other method might have resulted in taking credit for a profit that might never be earned. In recent years there has developed a much greater readiness to take credit for profits on uncompleted transactions, in order to secure a more useful guide to earning capacity...[40]

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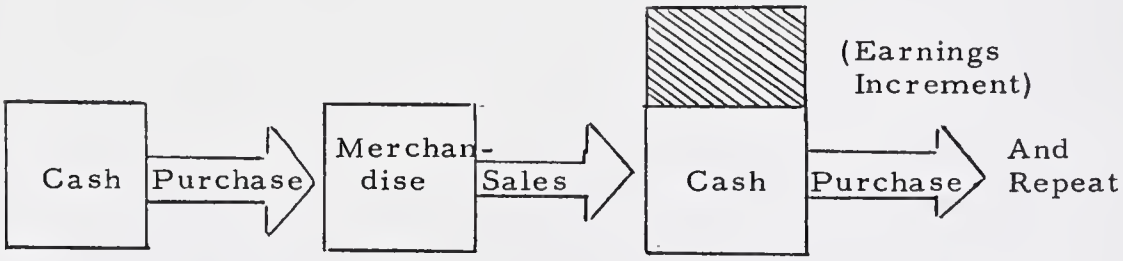
[40] Ibid., pp. 13-14.

The general thesis is correct under the assumption given. If a firm engages in a repetitive process of purchasing and selling at constant prices in constant quantities with constant time lapses, the recognition of income at sale will yield a "valid" figure. More precisely, it will yield a constant income figure for all temporal instants except the first and the last.

This assumption--stable-firm--is common to many accountants. A typical graphical representation of it is found in Robnett, Hill and Beckett under the title "The Repetitive Nature of Business Operations."[41]



If we take Mr. May's assumption of exact uniformity and assign t_0 to the instant of the first (at the businesses' inception) purchase, which is to be sold at t_1, and another purchase at t_1 to be sold at t_2, etc., and the last (at the cessation of the business) sale at t_n, we can represent it in full as in Figure 19.

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[41]R. A. Robnett, T. M. Hill and J. A. Beckett, Accounting: A Management Approach (Homewood, Ill.: Richard D. Irwin, Inc. 1955), p. 13.

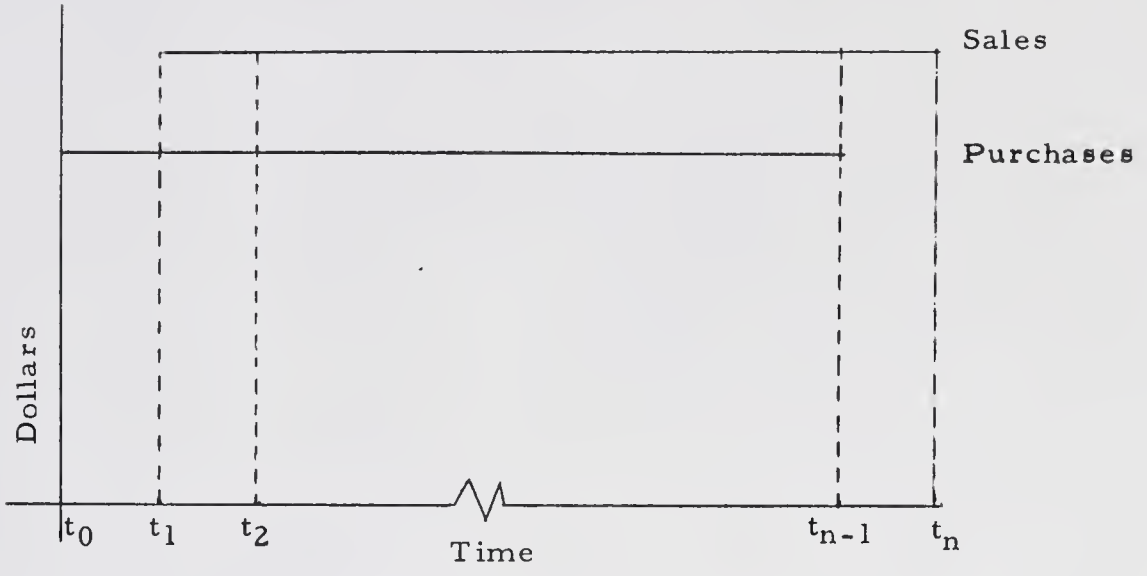

Figure 19

At t_0 a product is acquired costing, say, \$100 and is sold for, say, \$125 at t_1. Another purchase for \$100 is made at t_1 and sold at t_2 for \$125 and so forth until the firm makes its final sale at t_n and closes down.

The accounting rules require that the cost of the merchandise be deferred until sold, at which time the cost expires and is matched against the revenue. There is an asset of \$100 from t_0 to t_n. The first revenue occurs at t_1 and the asset acquired at t_0 then becomes an expense. Revenue remains constant from t_1 to t_n at \$125 and expenses remain constant at \$100 and thus a profit of \$25 per instant. In short, the accountant shifts the purchase curve one instant to the right and changes its name.

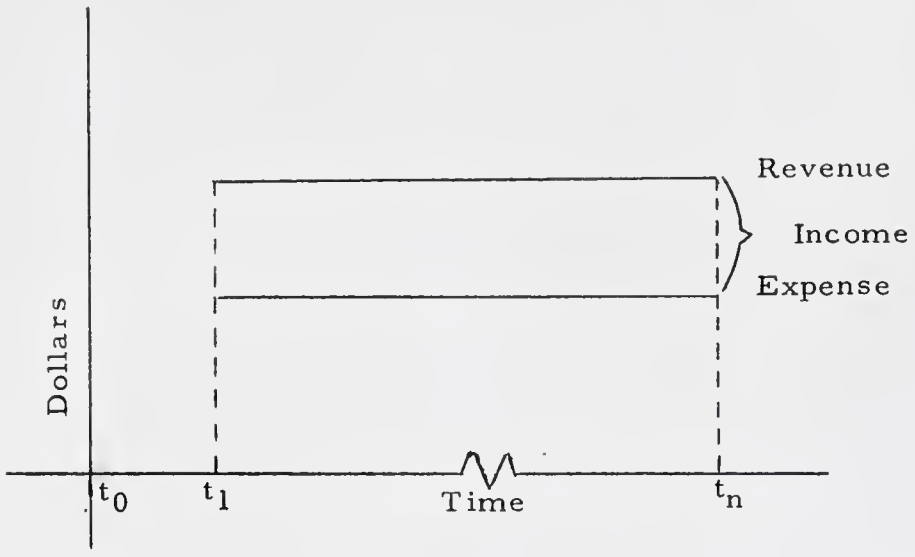

Figure 20

Under these assumptions, the virtues ascribed to the rule are perfectly correct. As May points out, the rule "would produce the same result" as an allocation according to the "proportion of completion." We agree. Our only criticism is that he did not go far enough. Precisely the "same result" would be achieved by recognizing income on the cash-basis, the sale-basis, the purchase-basis, or more simply by recognizing it on Tuesdays, equinoxes, or phases of the moon. Except for the first and last instants, any uniform basis would produce the "same result." Thus, we could ask what is special about the sale-basis that would cause us to select it as the only point for revaluations. Unfortunately, Mr. May does not address this question. His argument for sale-basis is equally applicable to all other temporally uniform bases.

Further criticism is unnecessary, but we should note in passing that May's assumptions are highly unrealistic. They are enlightening, though, because the stable-firm stable-economy assumption is made explicit. In addition, the concern over futurity is implicit in the assumed profits of purchases and sales. The purchased good has value (at cost) because it will be sold in the succeeding time period.

We reject May's argument for two reasons: (1) the assumptions are highly unrealistic, and (2) even granting the assumptions, the argument does not delineate the correct valuation procedure. We think that our conservative hypothesis serves as a reasonable explanation for the latter. May was probably seeking a means of justifying an existing practice and hit upon the stable-firm assumption. The conservative practice came first and the rationalization later. This is conjecture, of course, but the reverse hypothesis would be uncomplimentary as well as unlikely. For a man of May's stature to make the assumptions and then reason to his conclusion without recognizing all the other possible conclusions is dubious.

Paton and Littleton

About thirty years ago the American Accounting Association became increasingly disturbed about the lack of theory in accounting. They formed committees and study groups in order to remedy the deficiency and "to bring order out of this chaos of

conflicting ideas and practices."[42] Their major accomplishment was the publication of An Introduction to Corporate Accounting Standards which they hoped to "be one of the really significant contributions to accounting literature."[43] If acceptance, use, and citation, are the criteria, their hopes were realized. Standards immediately had a tremendous influence on accounting thought and has since become a classic. It has been accurately described as the "accountants' theoretical bible." For this reason, we feel obliged to analyze their argument for the cost rule.

Our consideration of Standards is much more difficult than that of either Finney or May because we are unable to locate a concise argument that we could analyze. The discussion is somewhat diffused and the reader will have to depend upon our outline of their argument instead of a complete direct quotation. That is the source of our first criticism. One would hope that such a basic treatise would present a rather full argument for their valuation method. Unfortunately, this is not the case, and it is a major defect in an otherwise noble effort.

Their approach is to derive "standards" (norms for behavior)[44] from "concepts."

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[42]Paton and Littleton, Standards, p. VI.

[43]Ibid.

[44]"Accounting standards therefore become responsible for furnishing guideposts to fair dealing in the midst of flexible rules and techniques." Ibid., p. 2.

> The circumstances surrounding the use of accounting clearly indicate the need for accounting standards. But such standards cannot be determined by an appeal to authority or to common opinion. The doctrines supported by writers and the practices accepted by professional accountants need to be subjected to analysis and coordination, with a consequent sifting out of inconsistencies and unessentials and an integration of essentials. The approach to standards should be by way of the broad function of accounting so that the standards formulated may be relevant thereto, and by way of the basic concepts or assumptions underlying accounting so that the standards formulated may be well grounded. To be relevant, a standard needs to be clearly related to the essential purposes of accounting; to be well grounded, a standard needs to be recognized as resting upon known and accepted assumptions.
>
> The basic concepts, or assumptions, here summarized constitute a suitable foundation for the discussion of accounting standards which follows.[45]

Thus, the behavioral norms (standards) spring directly from the assumptions. There are several headings in the chapter, which presumably are a list of these basic assumptions. Under each of the headings--assumptions--there is some statement about cost, with no consideration of any competing method of valuation.

Under "The Business Entity" assumption, they write:

> With the entity concept as a basis, there is no difficulty in accepting the proposition that all costs legitimately incurred by the enterprise are properly included, in the first instance, in the total of assets. Thus

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[45] Ibid., p. 7, emphasis supplied.

> organization expenditures, costs of raising capital, and related charges are elements of enterprise assets and capital.[46]

Their analysis is concerned with the segregation of business from personal affairs and what items can be properly included as assets. After they justify the inclusion of certain items, the term "cost" is utilized as a general description. They do not give reasons for their selection of cost as opposed to another value.

Under the "Continuity of Activity" assumption, they write:

> To the courts, concerned with the problem of determining immediate equities and restoring rights if damage has been suffered, assumptions with respect to future activity seem largely irrelevant. Hence the stress on "values" and "valuations" rather than on costs and the processes of accounting for costs. The accountant, on the other hand, deals primarily with the administration of the affairs of the continuing business institution and accordingly emphasizes the flow of costs and the interpretation of assets as balances of unamortized costs.[47]

They never say why he "accordingly emphasizes the flow of costs," simply that he does emphasize it. In fact, they say that "earning power--not price...is the significant basis of enterprise value." But what they mean by earning power is income, and they define income as the proper matching of costs and revenues.

Under the "Measured Consideration" assumption, they substitute the term "price-aggregates" for "cost"; and then in

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[46] Ibid., p. 9.

[47] Ibid., pp. 10-11.

the summary they conclude that "price-aggregates involved in the exchanges...constitute the basic subject matter of accounting." The word "consideration" is being used here the same as it is in the law of contracts, i.e., it means the amount given in exchange. Thus one of the basic assumptions of accounting is "consideration" which is then restated as "the basic subject matter of accounting." The next assumption is that "Costs Attach." Then, "Costs are considered as measuring effort" under the assumption of "Efforts and Accomplishments." Under the "Verifiable, Objective Evidence" assumption, they never mention price-aggregates or cost (except the cost of obtaining evidence); yet in the summary, the reasons given for costs being the basic data is that they are "objective."

The full quote in the summary is:

> In general, the only definite facts available to represent exchange transactions objectively and to express them homogeneously are the price-aggregates involved in the exchanges; hence such data constitute the basic subject matter of accounting.[48]

Their concern is only exchange transactions, i.e., costs are proper for the valuation at time of exchange, but they do not say why costs are proper for subsequent valuations. One could hypothesize about the reasons for their conclusions but it would be preferable if they stated them.

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[48] Ibid., p. 7.

Perhaps the explanation for the use of cost without justification lies under the last heading. Under the "basic concept or assumption" of "Assumptions" they write:

> The fundamental concepts or propositions of accounting, like those of other fields, are in themselves assumptions in considerable measure or are predicated upon assumptions which are not subject to conclusive demonstration or proof.[49]

It appears that cost is one of the more basic assumptions which is not subject to proof. Upon this basic assumption they build their superstructure of concepts.

Stout evidence that they assume the cost rule comes from the peculiar character of their methodology. Their approach is tersely stated in the preface.

> We have attempted to weave together the fundamental ideas of accounting rather than to state standards as such.[50]

That is, they have taken the fundamental ideas that they have found in practice and woven them together.[51]

In his later writings Mr. Littleton makes this methodology more explicit. He devotes an entire chapter to "Inductively Derived Principles," i.e., observing the practices of accountants

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[49] Ibid., p. 21.

[50] Ibid., p. IX, emphasis supplied.

[51] L. Goldberg, "The Present State of Accounting Theory," Accounting Review, XXXVIII, No. 3 (July 1963), p. 457.

and then weaving them together into principles.[52] One idea that they found was cost.

> The assumption that recorded dollar cost continues to represent actual cost permeates accounting thought and practice, as it does the law.[53]

Upon finding this permeation they, presumably uncritically, wove cost in as their basic assumption. It is hardly surprising, therefore, that the final chapter concludes that cost is the proper value.

It would be unkind to accuse them of circular reasoning. Their arguments turn out to be circular but this is because of their methodology. They conceive their role to be one of rationalizing (making rational) the extant practice of accounting. Thus, they are not guilty of circular reasoning because they do not attempt to reason from premise to conclusion. They take the existing ideas and try to connect them, they are apologists in the strict sense of the term. As it turns out, they are apologists for a practice that is conservative.

The Liquidity Argument

A number of authors have argued that income should not be recognized until the asset that it represents is in liquid form. This is the "separation controversy" which was referred to above.

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[52]A. C. Littleton, Structure of Accounting Theory (Menasha, Wisc.: George Banta Publishing Co., 1953).

[53]Paton and Littleton, Standards, p. 23.

The basic notion is that an asset must be in a form that is distributable, available to pay dividends. The most available, liquid asset is cash and this may be one of the reasons underlying the accountants' preoccupation with exchanges and money.

We do not know exactly why the accountant takes this position. There has been little analysis in the literature since the Eisner vs. Macomber case. The profession seems to believe that the court settled the "separation" issue and nothing was left to be said. Bowers has pointed out that this is based upon a misunderstanding of the court's decision.

> This decision seems to have been misunderstood by many practitioners and textbook writers. The court did not hold, as is often supposed, that a stock dividend in the same class of stock is not income. The earlier Macomber decision had merely denied that the receipt of common stock constituted effective realization if received as a dividend on common stock, that is, if it were merely capitalized surplus which was already a common stock equity.[54]

The court held that the receipt of stock did not effectively change the position of the recipient since it was simply a different form of equity which he had previously owned. Thus, it could be interpreted to mean that the "income" arose before the issuance of the stock dividend.

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[54]Russell Bowers, "Tests of Income Realization," An Income Approach to Accounting Theory, eds., S. Davidson, D. Green, C. Horngren, G. Sorter (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964), pp. 90-91.

Because of this misunderstanding, the separation notion seems to be an assumption of accountants. This hypothesis is strengthened by the absence of analysis and the occasional explicit statement that it is an assumption. For example, Bowers discards the economic power on measurement grounds and then assumes availability.

> If the economic-power theory has any conceptual superiority the possibility of applying new measuring devices should be studied more carefully. In the remainder of this article it will be assumed that the efficacy of any realization criterion lies in two essential attributes, first, measurability, and second, availability.[55]

The reason behind the assumption is that income is not available to pay dividends until it is in liquid form. Accountants "help" management by restricting income (receipts) to assets that are in distributable form. From this they assume that income cannot arise until the availability criterion is met. The argument is confused and unsound.

First, there is the possibility of paying dividends in kind. This has been done, particularly during the Great Depression, but it is cumbersome. It is more convenient to pay cash dividends and, of course, this requires possession of cash before they can be paid. Usually a corporation has several sources of cash. It could, for example, pledge a non-liquid asset on a loan

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[55] Ibid., pp. 91-92.

and obtain sufficient cash to pay a dividend.

More important, however, is the confusion of two separate concepts. The possession of cash is a question of fact about the form of the assets at a given moment in time. The income question is concerned with changes in wealth over time. If the ability to pay cash dividends is the sole criterion, the income question becomes the ultimate in simplicity. Either the company has cash or it does not, and that is the end of the problem.

In their writings on "Earned Surplus" or "Retained Income," accountants do not only recognize, they emphasize, the difference between the two questions. They lament the confusion resulting from the equation of "Retained Income" to "ability to pay dividends." In an effort to prevent this confusion, they carefully point out that the final determinant of dividend payments is the availability of cash, not income.

Hill and Gordon present a fairly typical statement.

> This order gives recognition to the fact that dividends are legally paid out of accumulated, rather than current, earnings. In this connection, it should be noted that while dividends are declared "out of earnings," they are paid "out of cash." Consequently, insofar as past retained earnings have been invested in productive assets, they are not available for distribution. An examination of Exhibit 3-1 reveals that the Avery Company would have found it difficult in either 1957 or 1958 to make such distributions up to the legal limit (i.e., up to the amount of retained earnings).[56]

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[56]T. Hill and M. Gordon, Accounting: A Management Approach,

That is, dividends are distributions of income but a separate requirement is that the assets must be in distributable form.

When the "income is reinvested in productive facilities," it is no longer in distributable form and this is exactly what has happened in the majority of corporations in America. It is very common to find the Retained Earnings figure to be several times the amount of cash and it is not uncommon for it to be larger than total current assets.[57] It is clear that such a situation prohibits the immediate payment of cash dividends equal to the income, and it is clear that the accountant recognizes it. Their cognizance somehow leads them to the conclusion that liquidity should be the deciding factor in the recognition of income.

A consistent application of the liquidity argument would require that income could never be more than cash-on-hand. Thus, even if income were realized upon receipt, it would have to be dis-realized upon the transformation of cash to a non-liquid asset. Since most corporations have an aversion to holding idle cash, income would be realized only momentarily.

For example, suppose that the trader started with $100

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rev. ed. (Homewood, Ill.: Richard D. Irwin, Inc., 1959), p. 51.

[57]For example, Caterpillar Tractor Company consistently reports Retained Earnings at around ten times the amount of cash and approximately twice the quick assets. The ratio has been fairly constant despite the "payment" of stock dividends. Cf. their annual reports.

cash at t_1 and had $150 cash at t_2. This meets the distribution requirement and the unequivocable amount of income is $50. If one instant later he purchases wheat, the distribution requirement is not met. Should we dis-realize his income? If so, has he suffered a loss? Of course the accountant would not dis-realize the income. He would value the wheat at $150 (cost) and enter the difference in the "Retained Income" account. Thus, "Retained Income" is different from "income."

A report at t_3 will show zero "current income" regardless of how high the price has gone because the "current income" is not in distributable form. However, the t_3 report will show $50 of "Retained Income" which also is not in distributable form. The only difference between current and retained income is the period of time that is covered. Retained income includes all income from t_1 to t_3 and current income is only that income from t_2 to t_3. Thus, the inclusive income concept, the longer period income, does not meet the distribution requirement, but the requirement must be met before the shorter period income can be realized. Something is not quite right here.

If Devine's notion of administering working capital is taken literally, we can be more insistent that income be dis-realized.

> For our present purposes the important aspect of income realization is that accountants usually <u>insist on helping</u> management administer its working capital by <u>recognizing</u>

> income only when working capital is available to permit withdrawal (if desired) without impairing the current position of the firm.[58]

The accountant restricts the amount of legally payable dividends by not recognizing income until it is liquid. Leaving aside the ethical question of the accountant taking it upon himself to do this, it is clear that the accountant could be of even more "help" if he dis-realized income when there was no cash available. If he thinks that management needs help on financial matters, it would be eminently reasonable to reduce income at least to the cash-on-hand, and perhaps he should even deduct planned disbursements.

We are not seriously suggesting such a procedure. Instead we are trying to emphasize that the problems should be separated by showing that the connection leads to absurdity. We think that the liquidity argument is nothing more than conservatism--Devine's article is an attack on the notion that losses need not be "realized"--being evidenced again.

Going-Concern Argument

The going-concern assumption is common to almost all accountants. We noted above that May used the future tense in

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[58]C. T. Devine, "Loss Recognition," An Income Approach to Accounting Theory, eds. Davidson, Green, Horngren, Sorter (Englewood-Cliffs, New Jersey: Prentice-Hall, Inc., 1964), p. 163, emphasis supplied.

describing his model enterprise. Textbooks seldom fail to list it as a "standard," "convention," etc. The following is fairly representative:

> When the future is unpredictable, one can only assume a continuity of existence and a business environment to follow that is similar to that in which the enterprise finds itself currently. The business unit, thus, is viewed as a "going concern" in the absence of evidence to the contrary. The continuity assumption is support for the preparation of a balance sheet that reports costs that are assignable to future activities rather than realizable values that would attach to properties in the event of voluntary liquidation or forced sale.[59]

The assertion that one "can only assume a continuity of existence" is absurd. One can assume anything he pleases about the future. There is a continuing philosophical debate about what one should (logically) assume, but we have found no philosopher who prescribes one assumption. We briefly reviewed Russell's notion of the future above and his position is essentially ours. There are people who disagree with Russell, but even the most future-minded of the philosophers--Wills for example--insist on an evidentially based (historical) projection, not an assumption. The high rate of business failures would make it difficult to build an evidential case for such an assumption. No business has ever continued indefinitely into the future. All businesses, except

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[59]H. Simons and W. Karrenbrock, Intermediate Accounting, 4th ed. (Cincinnati: South-Western Publishing Co., 1964), p. 48.

those presently in existence, have ceased operations. Thus, it would seem more reasonable to assume cessation instead of continuity.

A case could be built for a mean life-expectancy of businesses and this, like other statistical generalizations, would have some conceptual use. However, the generalization is about a universe and to apply it blindly to any particular element in that universe would be a gross misuse of statistical projection. Surely, no one would assume that a leukemia patient is expected to reach age 70.

It is difficult to come to grips with this assumption. A great deal has been written about it, but all writings take the form of bald assertions. There seems to be little reasoning behind it and even less evidence. Another investigator had similar difficulties:

> The continuity (or permanence) of the business enterprise. Relatively little can be found explaining this concept other than (a) the postulate itself--that in the absence of actual evidence to the contrary, the prospective life of the enterprise may be deemed to be indefinietly long, and (2) [sic] the statement that it is an accepted postulate because continuity is typical of all entities.[60]

Our research leads us to the same conclusion. We think that the reason why relatively little is said about it is because there is relatively little that can be said about it. We have a propensity

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[60]Arthur Anderson & Co., The Postulate of Accounting (September 1960), p. 18.

to be suspicious of bald assertions and, therefore, we reject (a). A perusal of Dun's Review of Business Failures leads us to deny that "continuity is typical."

For purposes of discussion, however, let us make the continuity assumption and examine the valuation consequences.

Futurity is an over-riding concern of the accountants. This is apparently contradictory because accounting is generally thought to be purely historical. Further, most accountants think of themselves as recorders of past acts. Yet the "benefit theory," "matching process," "attaching notions," etc., are clearly futurity concepts. A typical statement of the criterion for distinguishing between a positive and a zero value follows:

> (1) any acquisition cost or portion thereof which is productive of current period revenue is an expense, [zero value] and
>
> (2) any acquisition cost or portion thereof which is to be productive of future revenue is an asset [positive value].[61]

Thus, to follow these rules, the accountant assumes the continuity of the firm and then projects the benefits from each individual expenditure.

From this, he reasons that the proper value of these projected benefits is always equal to the historical cost. This reasoning normally takes the form of concentrating on the intended-

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[61]Hill and Gordon, Accounting: A Management Approach, rev. ed., p. 168.

use and disallowing alternatives and/or sacrifices. The following is typical:

> Even when a disparity exists between old costs shown in the balance sheet and current values, the usefulness of the balance sheet is not destroyed, because in most cases the assets in question will have been acquired to be used and not to be resold. In such cases current values often are of slight significance to a "going concern" (an established business which is being conducted with the expectation of continuing indefinitely), because in most cases, assets with current values differing materially from cost would be such things as buildings, machinery, and equipment that were acquired to be used and not to be resold.[62]

We fail to follow the reasoning that connects intended-use and value. We can understand how the expected net revenue from an intended-use affects the valuation decision of a given entrepreneur, but since those expectations are certain to change over time,[63] the value would also change. Only if one assumed that the expectations remained constant could the intended-use have a one-to-one relationship with value. If one takes this view, the intended-use notion is additional evidence for the existence of the "stable-firm stable-economy" assumption.

Moonitz explicitly denies the stable economy assumption by introducing uncertainty and defends the use of cost as an initial value.

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[62]Finney and Miller, Introductory, p. 10.

[63]Except perhaps in the very limited case of a government perpetuity.

> The choice of cost as the basis of initial valuation is, in most cases, reasonable.[64]

However, in a refreshingly candid statement, he points out that cost is a conservative value, initially, and further that the subsequent valuation at cost is solely on the basis of conservatism.

> In terms of the basic accounting problem, the cost rule is apparently conservative. Initial entry at cost results in no change in the difference between assets and liabilities; the acquisition of merchandise or of a fixed asset is treated as a "dead-level" transaction without effect on profits or proprietorship...at dates subsequent to purchase, the reasons for adherence to cost differs. Here the rationale is frankly on conservative grounds.[65]

We are in complete agreement with Mr. Moonitz' assessment. Note, however, that his justifications of the cost rule are based on futurity considerations. His theoretical framework is very close to the Fisher Tradition, although his conclusions vary.

Moonitz' notion of value is grounded firmly in expected future receipts of cash. He makes this explicit in several places.

> ...for only through a carefully prepared projection of estimated cash receipts and cash disbursements, based on past experience corrected for anticipated variations, can the value amounts assignable to any of the items that become reflected in the financial picture of an enterprise be even approximately determined.[66]

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[64] M. Moonitz and Louis Jordan, Accounting: An Analysis of its Problems, rev. ed. (New York: Holt, Rinehart and Winston, Inc., 1963), I., p. 168.

[65] Ibid., pp. 168-169, emphasis supplied.

[66] Ibid., p. 126.

Moreover, and this is crucial, these cash receipts must come from the intended-use of the assets. In neither of his cases--complete certainty and complete uncertainty--does he ever consider any alternative use of the assets; presumably because he thinks that only the intended-use is relevant to valuation problems. But under complete uncertainty the intended-use cash receipts are unknown and, therefore, no valuation can be made.

> When the future is presumed to be completely unknown, our accounting must deal entirely with the past. We can prepare, for example, a schedule of cash received to date and from whom, and of cash paid out to date and for what. But we cannot prepare a balance sheet, because each asset in a balance sheet represents something applicable to the future, and each liability likewise indicates a commitment to do something in the future.[67]

The underlying assumption must be of the locked-in variety. Otherwise the prospective receipts from a sale of the asset would yield some recordable value. We can think of no justification for the intended-use valuation other than the locked-in assumption. If this be his assumption, we are basically in agreement with his conclusions, i.e., zero value. (See The Fisher Tradition supra.) However, we do not see why the locked-in assumption should be made.

Because of this futurity notion most accountants claim that income cannot be measured until the enterprise ceases

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[67] Ibid., p. 127, emphasis supplied.

operations. Robnett, Hill and Beckett summarize this as an "inherent limitation" in accounting.

> Business earnings are fundamentally indeterminate short of the total life of the business venture. Any interim calculation of earnings is, therefore, an estimate....In the first place, potential difficulty stems from the necessity, noted earlier in this chapter, for forecasting the future in order to interpret the past. Underlying all interim valuation estimates is the general assumption that the business will continue as a going concern, i.e., that it will function in the future in much the same manner as it has in the past.[68]

Note the odd twist in the juxtaposition of their emphasized statements. All valuations, at all instants in time, are made on the basis of the going-concern assumption. This would include the "last" valuation when the Business has ceased operations. Thus, the earnings are always indeterminate. Of course this is not their intent. They mean that income is indeterminate until all assets are converted into cash. At that time one can take the difference in the cash magnitudes and determine the income finally and unequivocably.

This again points up the accountant's preoccupation with cash. He conceives income almost exclusively in terms of cash receipts and disbursements but, facing uncertainty, he cannot forecast the cash movements and, therefore, denies his ability to measure income. This is an uncomfortable position. He claims

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[68]Robnett, Hill and Beckett, pp. 509-510.

to measure income on the accrual basis but conceives of it on the cash basis and then denies that he can measure it. We have noted the impossibility of measuring future events above and we can sympathize with the accountant in his self-imposed dilemma.

We do not understand the going-concern assumption. First, we do not know why the assumption is made and second, we do not understand how it leads to the cost rule. The assumption seems to have sprung from Dicksee's consideration of parliamentary companies (public utilities) who were required to continue operations. Thus, the intended-use of the asset was the only source of receipts and price fluctuations were irrelevant except at replacement. However, Dicksee did not apply it to private enterprises;[69] instead he suggested a net worth accretion measurement. Perhaps the reason why the specific has become general is that in the periods of rising prices, the net worth accretion rule was unconservative.

This is a point of fundamental disagreement with the accountants. Our basic premise is that income is to be measured--an operation of discovering the numerosity of units of an existing condition--not a prognostication of the future.

Objectivity

The assertion that "cost is objective" is probably used

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[69]Lawrence Robert Dicksee, Auditing (London, 1892).

more often to defend the cost rule than any other single argument. There are several lines of reply, any one of which is sufficient grounds for rejecting this argument.

First, the construct criticism. We have indicated above that what is or what is not "objective" depends upon the construct of the perceiver.[70] Perception of reality is an epistemological question of vast consequences. Accountants have been extremely cavalier in their treatment of the problem. Usually they do no more than make an unsupported assertion that cost is objective and that other values are not. We consider their assertion unwarranted and deplore the irresponsible use of the term.

Second, the defensive criticism. We agree that cash receipts and disbursements are convenient and univocal. However, that is not the question. Every basic text lists widely varying

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[70]Mr. Chambers implicitly uses the construct criticism against his fellow accountants when he writes:

> It is no defense to argue that all accountants or auditors would agree that the method of accounting and reporting used is a method acceptable to them. That would be equivalent to asking the flat-earthists whether the earth is flat.

This is a felicitous statement. The accountants have been assuming that the earth is flat so long that they resolutely refuse to perceive the curvature on the horizon. They are so convinced of geocentricism that they drum out any prospective Galileos. R. J. Chambers, "Measurement and Objectivity in Accounting," Accounting Review, XXXIX, No. 2 (April 1964), p. 270, emphasis supplied.

alternatives for the initial recording of cash outflows. The "capital versus expense" and "capital versus capital" treatment of cash outlays is one of the most difficult areas in accounting. The continuing valuation problems are subject to even wider deviations. Lifo and depreciation disputes are well known, but the myriad of lesser "attaching" alternatives are relatively unfamiliar. The author once amazed himself by setting up a game tree which revealed over a thousand valuation alternatives in a rather simple enterprise. The degree of divergence is astounding. A glance at the literature discloses that the most discussed and hotly-debated issue is the lack of "uniformity" (divergency in valuations) in theory as well as practice. For the accountant to heap scorn on appraisals because they vary is the pot calling the kettle black. Like Mr. Paton, we marvel, nay, we stand in stunned awe at the affrontry of accountants who consider cost to be objective.

Third, the conservative argument. This has been detailed above. The telling datum is that accountants are always willing to record a "subjective" (other than cost) value if it is lower than the objective (cash outlay cost) value. No asset on the balance sheet is valued at its cash outlay cost with perhaps the single exception of land, and land is likely to be valued at cost only if the market price is above or equal to the cost. Almost all assets are valued at less than their cost because they have been subjected to amortization, allowances, lower of cost or market, or

some other procedure which results in lowering the value. The result is that the assets are valued at something other than their cost, i.e., they are almost all valued "subjectively."

The Study Group on Business Income, in characteristic British understatement, has written:

> Those who have favored adherence to present practice have commonly talked in terms of "factual" and "objective" determinations and "uniformity." They perhaps have not given adequate recognition to the extent to which accounting is necessarily characterized by "postulates," "estimates," "subjective choice of method," and "variety in methods."[71]

This may be true. Perhaps accountants, although they work with the materials daily, have not given adequate recognition to their own "subjectivity." We think that a more reasonable hypothesis might be that they resist change, i.e., another variation of conservatism.

Fourth, the information criticism. The final point is the strongest; yet it is most often misunderstood. Many writers outside the field continually refer to the precision and objectivity of the data. They lament the lack of theoretical validity but excuse it on practical grounds. We have demonstrated that the cost figures are neither precise nor "objective." However, even if they were, they are irrelevant.

We have set forth our problems and constructs above and

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[71]Study Group on Business Income, Changing Concepts of Business Income (New York: Macmillan Co., 1952), p. 50.

specified the data that is relevant. There was a noticeable absence of historical cost data on any of those lists. A guess at a relevant figure is infinitely more valuable than a precise and objective irrelevancy. If one's construct prescribes that length is relevant and radioactivity is not, then radioactivity has zero value regardless of its precision or objectivity. A rough estimate of length has at least some value, no matter how imprecise or unobjective.

Fifth, from a pure communications viewpoint, all the transmissions of cost, save the first, have zero value simply because they repeat information that was contained in the last message. Repetition, in a noiseless channel, is wasted effort.

Methodology

Although the accountants' methodological statements are not per se arguments for the cost rule, they are often used as ancillary support for that rule. Thus, it is incumbent upon us to examine their methodology. A complete survey of methodology would be a study in itself, but the differences between the author and the Accounting Tradition are so basic that a few comments must be made before we proceed.

Mr. Louis Goldberg has reviewed the accounting literature and has classified the "theories" as "gerundive" and "substantive." The former--gerundive--are described as "rationalizations" of the existing practice of bookkeeping. The latter is theory in the

more ordinary usage.[72] Theory in the gerundive sense, what we have previously called apologetics, has been well documented by many writers and the profession has often bewailed the fact that this was the only kind of theory in existence. Mr. Greer, in the preface to Standards, indicated that this was the prime reason that the committee commissioned Paton and Littleton to write their treatise. He noted that the texts on theory "concentrated on the facts of existing practice,"[73] and that Paton and Littleton were to "make order of the chaos" by presenting "a coherent, coordinated, consistent body of doctrine."

Note, however, that the result was another gerundive theory. Paton and Littleton took the extant fundamental ideas and wove them together. This is still apologetics. Later, Littleton wrote his treatise on methodology, which turns out to be apologetics for apologetics.

Littleton points out that accounting theory has developed out of practice and that its character is gerundive--apologetic.

> We know that accounting practices were developed and in use before theories appeared explaining the things done....Methods devised by many different people were used... [and became] ...generally accepted practices. Teachers of bookkeeping and later of accounting and auditing found it necessary to supplement the accumulated rules and descriptions of procedure by explanations and justifications. This was

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[72]L. Goldberg, "The Present State of Accounting Theory," Accounting Review, XXXVIII, No. 3 (July 1963), p. 457.

[73]Paton and Littleton, Standards, p. V.

> done in order that study should be something more than the memorizing of rules. Hence it is appropriate to say that both the methods of practice and the explanations of theory were inductively derived out of experience.[74]

Thus, theories are nothing more than explanations of things done by accountants. They were derived to justify and explain to students in order to avoid memorization. This notion pervades the entire treatise. In another chapter he sets up a heading entitled "Theory as Explanation" and writes:

> Evidently accounting theory, far from being an exercise in abstract hair-splitting, is simply thinking that is focused upon doing. Practice is fact and action; theory consists of explanations and reasons.[75]

He proceeds to explain that, in accounting, there are no "immutable laws" and that it is not "scientific"; yet there are "relationships."

> These relationships are not so precise and measurable as to produce laws and formulas. But there are truths in accountancy, truths that rest upon such factors as carefully defined classifications, closely drawn distinctions, clearly perceived objectives, a strong sense of relevance among data. When these truths, these significant relationships, are formulated in careful phrasing, we may find that principles of accounting are emerging.[76]

This seems clear enough, but how does one define classifications,

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[74]Littleton, Structure, p. 185, emphasis supplied.

[75]Ibid., p. 132.

[76]Ibid., p. 135, emphasis supplied.

draw distinctions, perceive objectives, sense relevance? In short, how does one come upon principles or truths? For Littleton, the proper procedure is induction.

He says that "the object of this chapter" is "to show... that accounting principles can be derived inductively out of accounting actions."[77] Yet earlier he says that viewed broadly, "theory can properly be called a body of doctrine. It is an area of beliefs, explanations, and justifications related to an area of practice."[78]

We are at a loss. Theories are beliefs, doctrines. Truths (Principles) are defined classifications, drawn distinctions, perceived objectives, sensed relevance. In short, they are all mental constructs of a person and this person derives these constructs by observing other people. This is absurd. One may describe the activities of people; one may get insights about the underlying motives by observing them; this is acceptable methodology in Anthropology and Sociology. But how does one get from there to standards (norms of behavior), beliefs about what should be, or principles-of-prescription from observation? Just the opposite has occurred. Anthropology has described behavior but has been very careful to avoid value judgments or to attempt to prescribe general laws of behavior.

More directly, can one gain insights into the principles of

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[77] Ibid., p. 186.

[78] Ibid., p. 175, emphasis supplied.

measurement by observing a metrician? What if he is measuring hage? Can one learn how to measure the velocity of atomic particles by observing a surveyor?

We are in fundamental disagreement with apologetics as a methodology. Littleton is the foremost proponent of this methodology, and we agree with Mr. Goldberg when he says that Littleton "got somewhat out of his depth" when he tries to defend apologetics.

> His "theory" is too obviously and too directly geared to the providing of rules of action; one gets the impression that the theory he proposes or rather his "theoretical" propositions are rationalizations of practice, whether present or prospective.[79]

We agree, especially with the quotation marks. We would not dignify rationalizations by calling them "theory."

Another aspect of this methodology was recently pointed up by Raymond Marple. In a rather vitrolic attack on the recent "substantive" theories, he presents his case against logic. He poetically describes logical, substantive theory as an illness:

> In the accountant, and particularly the academic theorist, this condition seems to be brought on by overexposure, malnutrition and neglect--overexposure to economic theory, malnutrition from a diet lacking in economic realities, and neglect of the lessons taught by history.[80]

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[79]Goldberg, "The Present State of Accounting Theory," p. 462.

[80]R. Marple, "Value-Itis," Accounting Review, XXXVIII, No. 3 (July 1963), p. 478.

In other words: "Ivory tower theorists who have never met a payroll are rocking the boat."

> [They]...assume that there must be a set of unifying laws or "principles" which govern accounting for all purposes and that these principles can be discovered by "logical analysis."
> ...Nurtured in the academic atmosphere which stresses theories and logic, encouraged to write for publication because it improves their academic standings and free of any necessity to apply these theories in actual business practice, some academic theorists are encouraged by the present emphasis on accounting principles to look at accounting as solely an exercise in logical analysis.[81]

We plead guilty to all counts. Our disagreement with Marple's methodology, or more accurately his lack of an explicit method, is so fundamental that we would have to start with the Logos to explain it. However, the battle is so ancient--the logical academes versus the practical men of affairs--that we do not feel compelled to do more than note it and pass on.

The final methodological dispute is with the operationalists. Several writers stress that the operation must be disclosed in order to make the data meaningful. This is related to the principle of full disclosure. Robnett, Hill and Beckett provide typical statements:

> We should realize, therefore, that depreciation charges and the residual unamortized costs of depreciable assets can be meaningful only when

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[81] Ibid., p. 479.

> the amortization methods employed are clearly understood....The figures...are fully understandable only if the underlying accounting policies are known....then the estimated margin meaningful only in terms of the particular method used to allocate the joint material cost.[82]

The clear implication is that accounting figures are meaningful when the operations are disclosed. We have previously pointed out that the conditions under which the measurement was made is an important datum. However, the communication of the conditions does not necessarily make the data "meaningful." A "hage" is not meaningful no matter how detailed the specification of conditions. If the basic data is not relevant, then no matter how operational one becomes, the result is without meaning. That is the situation in accounting. The basic data is cost and it really does not matter how it has been amortized, allocated, or adjusted because cost has no relevance to the decision construct.

Summary

Accounting is a discipline without any cohesive, unified theory of valuation. The extant valuation methods vary widely for a wide variety of reasons. The result is a confusing array of combinational possibilities of valuation.

We submitted the hypothesis that conservatism was the fundamental principle of valuation. Evidence in support of this

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[82]Robnett, Hill and Beckett, pp. 510-511.

hypothesis comes from the following sources:

1. The history of accounting development produces a natural propensity toward conservatism.

2. Conservatism prevails when there is a conflict between it and other principles.

3. Writers in the field ordinarily justify a specific valuation procedure by appealing to conservatism even though they profess to be anti-conservative.

4. Criticism of conservatism often takes the form of using conservatism as the basic criterion.

5. Arguments for the historical cost-realization convention are manifestly specious when removed from the context of conservatism.

Because of the last point, we submitted the secondary hypothesis that the cost rule is, in fact, nothing more than a manifestation of conservatism. We examined several representative arguments for the cost rule and proved that they were neither valid nor sound. We think that this is sufficient evidence to support both the primary and secondary hypotheses.

Criticism of conservatism as a principle tends to take on a moral tone. Conservative accountants consider it a virtue; anti-conservatives consider it unethical. We would like to avoid moral controversies. Perhaps Hill and Gordon hit on the explanation when they described it as an "inborn tendency." We were not born with the tendency and, therefore, find ourselves in sharp disagreement with the principle.

In terms of measurement-information criteria, it is clear

that conservative measurements are not veritable. The final result of a deliberate understatement is deception, no matter how laudable the objective may be. It is clear that the intent is to deceive. It is also clear that the desired ends of the conservative are commendable, but we disagree with the means they choose to achieve that end. Since verity is a sine qua non of information, we must conclude that conservatism yields, not only zero information, but also, misinformation.

In our review of the metrics literature, we failed to come across a single instance of the advocacy of a conservative measurement. The word was never used. Some metricians confuse precision with verity and note that they are never "absolutely veritable" and bewail this fact. Precision presents many difficulties--both physical and philosophical--that mitigate against an absolutist position. Attempts to overcome these difficulties take many forms, but no-one suggests that the proper answer is deliberate understatement--conservatism. The concept is so antithetical to the theory of metrics that we would hesitate to call a conservative figure a measurement.

In our review of problems and constructs, we failed to find a single instance where a conservative figure was relevant. Historical cost was relevant only as an initial valuation. It was never relevant at dates subsequent to the purchase for valuation purposes. Thus, under the relevance criterion, conservative

figures have zero informational content and costs have negligible information content.

Moreover, the repeated transmission of historical cost data, even if it were relevant, would be prolix. It violates the raison d'etre of the transmission by reverting to the completed exchange time of valuation. Information is desired at a specific point in time, but the historical cost method simply repeats a previous message. Under this method the message will be continually repeated until the exchange is completed. Thus, from a pure communications viewpoint, all the messages, save the first, have zero informational content.

In addition to these generalized criteria, there are several points of fundamental disagreement between the author and the Accounting Tradition. Their valuations are based on a prognostication of the future-intended-use-receipts instead of a measurement of the existing conditions. On the other hand, the upper limit of value is a past sacrifice which can yield only a past value. The wide variation in valuation rules results in figures that are incomprehensible even to other accountants. The accounting methodology should be restricted to describing instead of prescribing.

Any of these criticisms alone should be sufficient reason to reject the Accounting Tradition. When taken in combination, there can be no question about the rejection.

CHAPTER X

PRESENT MARKET

Valuation at present market has been criticized by Boulding and the Accounting Tradition. Boulding's main objection is to the "meaningless fluctuation" and accountants usually speak of "objectivity." Both criticisms have been discussed above and demonstrated to be unsound.

The Fisher Tradition has no criticism to offer. In fact, most of Fisher's writing is directed toward the determination of an ideal-type price in order to compare it with the actual price (present market) and then make a decision. Fisher's disciples ordinarily present a positive program without criticism of methods outside the tradition.

Thus, there is no extant criticism that has not been refuted. The author has been unable to come up with a valid argument in opposition to the present market. Even the application of the Cartesian methodology of hyperbolic doubt yields nothing to indicate that it is unsuitable. In short, from the negative side, we have found no reason to cause us to reject the present market method of valuation.

From the positive side, as we demonstrated in Chapter VI,

everything indicates that we should accept present market. It more than meets the established criteria.

Valuation at present market yields the one figure that is relevant to all alternatives. The trader can compare this figure to his projections and decide on his position. The present market price is the amount that he presently sacrifices to obtain or maintain that position. The price allows him to relate the opportunities of consumption, holding cash idle, investing in other markets, etc. In short, it is the one numeraire that connects all of the goods in all of the markets. It is the sine qua non of an informative measurement because it permits a comparison of the relevant factors.

For the outsiders--the other interested receivers--it permits both interfirm (instantaneous), intertemporal and increment comparisons. It allows them to make their own prediction and compare it to the direction of the trader's expectations. It allows an intertemporal comparison so that they can make an ad hominem judgment if they so desire.

Being the difference between wealth at two points in time, income is a temporal concept. Present market measures that wealth--the sacrifice, the value--at two specified points. The timing of the measurement--the "present" at two instants--correspond to the raison d'être of that measurement. It is made at the instant that the information is desired. The measurement is of

an existing condition; it is neither the repeat of a past measure nor a projection of the future. As such it is additive. One can add the present market value of all commodities and make a meaningful, valid counterfactual statement about his existing alternatives. "If I had sold these commodities I would have had X dollars which could have bought any combination of goods whose total did not exceed X." In the intervening instant the price may have changed but that statement was valid at the moment that it was made and will forever remain valid in connection with that specified temporal location.

So long as the price level remains stable the present market will yield an additive intertemporal measure. The difference (Axiom 5) between two counterfactuals yields the change in the amount which could have been bought. It yields a difference in wealth, i.e., income. Under conditions of a perfect market the determination of the prices and hence, income, would be the ultimate in simplicity.

The final and telling point in favor of present market involves a conjecture about the constructs of the receivers. The communication of wealth and income figures go to a very large heterogeneous audience. A transmitter must make a judgment about how these receivers think. The question in its simplest form is do they think in terms of (a) unexpired costs, (b) constants, (c) discounted expectations or (d) present market prices?

In a market economy the answer should be obvious. Every housewife knows the price of potatoes and bread. She also knows her cash-on-hand and realizes, although she may never express it, that the purchase of potatoes precludes the purchase of the coveted fur coat. On the other hand, the notions of unexpired costs are arcane even to the businessman who has incurred those costs. The author has never met a businessman who fully understood or accepted the accountant's methodology. Experts on investment--financial analysts--have come to ignore the accountant's income figures in favor of cash-flows. To anyone who has ever taught the subject, it is obvious that the concept of discounting is foreign to all but a few. Because of the lack of use, constants would probably be more confusing than any other method.

The editors of one of the most popular magazines in America have made a similar judgment.

> The accounting firm retained by the President said, in explaining how they arrived at their low $3.5 million estimate: "The investments... [are] carried at cost, less allowance for depreciation or improvements....The amounts at which [they] are carried are not intended to indicate the values that might be realized if the investments were sold." Life considers it more realistic to give the amounts these properties would bring in a sale today rather than what they originally cost.[1]

They might have said that present market is not only "realistic"

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[1] Life, "Letters to the Editors," September 18, 1964, p. 32.

but also the way that their readers think about wealth. When people ask such questions they want to know what a person is "worth" today not what is property cost him at various unspecified times in the past. Such "cost" figures would not allow either a meaningful comparison among the candidates or a comparison of the increments of any one candidate.

The irony of all this is that the experts' function has been taken over by the novice. The accountant, by his refusal to submit the desired figures, has allowed, nay, forced the journalist to usurp the position of valuer. The accountant has maintained his unsullied state at the expense of becoming obsolete. The community would be much better served if this fierce devotion to independence and integrity were directed toward relevance. In his position as a respected steward of the community's wealth "it is high time that this nonsense of denying any ability as an expert in materials or values be stopped."[2]

At the lowest level of sophistication as well as at the highest decision-theory abstraction, the constructs of the receivers demand that present market be reported. This alone is a prima facie case for present market. Relevance is the overriding criterion without which all else is nought. Present market, however, has the additional virtue of meeting all the criteria including the

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[2]Devine in Davidson, An Income Approach to Accounting Theory, p. 171.

additive axiom which makes it acceptable even to the narrowest of metricians. There is nothing on the negative side and everything on the positive side.

Our models and assumptions have served the purpose of narrowing the subject to the point where our completeness bordered on tedium. Many of our readers would have granted the conclusion a priori, but we felt it necessary to go through the detail in order to lay a firm foundation for the models which are to follow. However, because of this detail in the analysis of the trader model, we are certain of our conclusion. At the risk of being presumptuous, we echo Mill's famous conclusion:

> Happily there is nothing in the laws of value which remains for the present or any future writer to clear up; the theory of the subject is complete: the only difficulty to be overcome is that of so stating as to solve by anticipation the chief perplexities which occur in applying it.[3]

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[3]John Stuart Mill, Principles of Political Economy, p. 436.

CHAPTER XI

THE ASSUMPTIONS RELAXED

There are two assumptions--perfect market and stable prices--which need to be relaxed in order to make our model more general as well as more realistic. We will maintain the other basic assumptions--the maximands--because they come closer to describing reality than any other generalization that has yet been put forth.

Perfect Market

There is no denying that the degree of difficulty in the determination of the present transco varies in the same direction, and probably more than proportionately, with the imperfections in the market. Unique goods present perplexing problems; fungible goods have a curvilinear transformation function when one potential buyer or seller has a relatively large quantity of cash or commodity. Even in the face of these hardships we argue that the present transco is the correct selection. Our reasons are:

1. The positive-relevance argument. A guess at the relevant figure is infinitely more valuable than a convenient irrelevancy. However,

we think that, when the problem is viewed in the proper light, many of the difficulties disappear and the resulting figure is more than a guess. It is, in fact, a measurement.

2. The negative-defensive argument. What is now being done is a very expensive ritual. It is almost pure waste and these resources could be more efficiently employed in the generation of the relevant figures. This is done partly in anticipation of the criticism that our method is "fine in theory but too expensive to be applied."

The first argument may be stated as a compelling conditional. If rational decisions are to be made, then the relevant figures must be furnished. The force of the prescription--the "must"-- depends upon the force of the antecedent. In our view the antecedent is compelling and therefore the prescription is irrefutable. The relevant figures must be furnished.

The decision requires a selection among alternatives. The total money that could be garnered by the sale of the commodity is the figure that relates these alternatives. The total money is the present sacrifice which the entrepreneur makes in order to obtain or maintain another good. Likewise, the sacrifice is relevant to all other receivers for both their instantaneous and intertemporal comparisons. Thus, the present market must be determined before rational decisions can be made. Relevance is a

compelling criterion which forces us to reject the previous rationalizations and to begin the task of overcoming the rigors of valuations.

From the viewpoint of metrics theory the problem is one of instrumentation and observation. We need to develop better instruments and train better observers. Stating the problem in these terms is not an attempt to gloss it over with verbiage. Instead it is an attempt to point the direction of progress. We cannot be certain of success in the attempt but we can be certain that the refusal to try will produce nothing. Mourning over the lack of instruments and rationalizing the existing practices simply entrenches the problem without contributing one iota toward its solution. Most of the effort expended is now in that direction. Little if anything is done in the direction of a solution.

There is now a considerable body of literature on appraisal techniques. Unfortunately it is still in its infancy and one suspects that there is a considerable lack of precision and we know that inter-observer agreement is at low level. The techniques must be refined and the standards of observation must be improved. In the meantime, the instruments at hand, imperfect though they may be, must be used for the compelling reason that no other instruments are available.

The conditions of such a measurement must be explicitly stated. The temporal element is central to the purpose of measurement and the resulting figure will be meaningless if it is not

stated. Likewise, place utility and transportation costs require that the spatial condition be stated. Thus, the measurement statement would come out something like the following:

> (In our best judgment the figure) X (is the total amount of cash that could have been received if this asset had been sold) at time t in location S.

The understood clauses are in parentheses. Omitting them, the message reads:

> $X at t at S.

The figure X will be imprecise and there will be disagreement about it. Note, however, that the same situation plagues the "exact" sciences. There have been sufficient experiments to demonstrate conclusively that the simplest of operations result in different magnitudes even when performed by highly qualified scientists with elaborate instruments.[1] This had led most metricians to the notion that measurements are probability functions and that perhaps the mean of several observations is closest to the "true" figure. Quite naturally then, there has been an increasing use of dispersion measures and confidence levels in the "exact" sciences.

There is no reason why such techniques could not be applied to market prices. Of course, it would be a greatly preferable situation if there was a perfect market and thus an unequivocable,

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[1]For a reference to these experiments see Churchman, Materistic Measure, pp. 485-86.

univocal figure. But in the absence of this ideal, standard deviations are a felicitous substitute. The size of the standard deviation would vary directly with the degree of market imperfection and the quantity held relative to the total supply. If the trader holds a relatively small quantity of a fungible commodity, the standard deviation should be quite small even if the market is highly imperfect. As the trader holds relatively larger quantities, so that his exchanges directly cause wide price fluctuations, the accuracy of the measurement depends upon the accuracy of the estimate of the demand schedule. In all likelihood this will result in greater divergence in observations and larger standard deviations.

Most of the past criticism of such measurements have been caused by confusion over the temporal location. Measurements of this kind are retrodictions--counterfactual conditions--in which the antecedent is false. The antecedent will forever remain false because the retrodiction specifies a past instant which will never recur. "If I had sold at time t" can never be verified by sale because the sale did not occur at t. If the sale had occurred the retrodiction would be pointless. Sales at other instants have no bearing on the verification of the measurement. To state that a sale at t_1 proved the appraisal wrong, as is often done, is nonsense. The appraisal was concerned with t, not t_1, and a sale at t_1 does not prove anything about the retrodiction. Subsequent sales are not pertinent.

The only means of verifying a retrodiction is by setting dtandards for observers and observations and then checking on the divergence. We can have "absolute" confidence in some retrodictions and less confidence in others. A glance at the newspaper would give the author absolute confidence that he could have sold wheat for exactly $2.13 5/8 at yesterday's closing bell. On the other hand, the confidence that one would have in the appraisal of a house (a unique commodity in a highly imperfect market) would be much lower. It would depend in part on the confidence that one has in the appraiser. No one would expect that an appraisal of $20,000 would yield exactly $20,000. However, one could be almost certain that the final figure would have been say, $20,000 $\pm$ 3($1,500).

The absence of verification by sale has caused, and probably will continue to cause, a number of people to reject the procedure. Some people seem to be uncomfortable with probabilities and to yearn for absolutes. It may be some comfort to point out that there are many procedures where verification by performing the relevant act is impossible. In quality control, verification by testing sometimes destroys the product (flash bulbs for example) and quite often, 100 per cent testing is too expensive. Sampling and statistical projection has been the answer. In quantum mechanics, there is observer-observation interaction which destroys the state that one is trying to measure. Projection from the observerable to the unobservable is the only data available.

No one would deny that we could be more certain of our figures if these conditions were not in the nature of things. However, to pre-test all flash bulbs would be absurd and to wait until they had all been used would be irrelevant to the decision. The only solution is to use the best device currently available and continue to try to refine it.

On a more abstract level it is difficult to conceive of a world without probabilities. All predictions and retrodictions have only a degree of probability and all of them presently in existence have not been completely verified. For them to have been verified, in the sense of the consequence occurring, we would have a world in which all conceivable actions have already occurred. Thus, we must operate at all levels "only" on the basis of probabilities, not certainties.

This is likely to be slight comfort for the absolutists who will reject our procedure as "unobjective" and "unverifiable." We are sorry about this, but from our viewpoint, that is the way of the world and there is nothing to be done about it.

The second argument is a criticism of the existing method of "measuring" income. More specifically the function of the auditor is called into question.

Every year the enterprise is obliged to call in an independent auditor to express his opinion on the fairness of the financial statements. The auditor arrives at his opinion by applying what

the textbooks call "professional judgment." The term is left undefined and unbearably vague. We would prefer Boulding's terminology and classify the auditing function as "ritual."

The author has had the privilege of observing two of the largest and most respected auditing firms in the country. They invite academics to participant-observer summer programs and we were privileged to attend. This practical experience coupled with the textbook ambiguities has led us to the "ritual" conclusion.

For example, on one occasion we participated in the audit of a corporation which had a large inventory of reusable containers. They were charged to "inventory" when bought and to "expense" on a lifo basis upon initial use. The containers that had been used at least once outnumbered the new ones by about 10 to 1. The auditors were very careful to verify the "inventory" (the unused containers). They spent about three man-days observing the firms' count and making spot-checks by counting certain sections themselves. Then they made sample tracings of the original cash outlays which had gone into and out of the inventory account. They never bothered to do anything about the used inventory "because the costs had already expired." Yet the used inventory had an intended-use value, as well as a market value, several times over the value of the unused. Since they were on lifo and were an expanding company, all of the costs in the inventory account were at least four years old and most were older. Thus, the market value of the unused was several times the reported value.

The result was that the company reported about one tenth of the quantity of their inventory and valued it at rather ancient costs. The auditors spent a great deal of time checking on this inventory before being willing to express an opinion that the figure did in fact "present fairly the financial position." When queried, the auditors replied that their only function was to ensure that the company had followed its self-established procedures and that all their efforts were toward that end. Further, they admitted that the company could have originally established different procedures which would have resulted in a value variation of about 2,000 per cent. This figure also would have "presented fairly" in their opinion. If they had found even the grossest error--a doubling or halving of the "correct" figure--it would have still been smaller than the acceptable variation. Surely such activity is, at best, ritual and, at worst, a tragic waste of time, effort and talent.

On another occasion the auditors discovered an error in the sale of a parcel of land. The bookkeeper had erroneously charged off the cost of an unsold parcel and left the cost of the sold parcel in the asset account. The junior auditor had discovered the error in a routine check of the account. He had traced back several incidental costs to ensure that they were properly capitalizable and found, of course, that the tax-minded management had expensed most of the costs. In tracing the credits he found that the description of the sale did not agree with the book

entry and thus discovered the error. The notation of the error on the worksheet occasioned several conferences; between the junior and his immediate supervisor, between the supervisor and the auditor-in-charge, between the autidor-in-charge and the head bookkeeper, at which time the correction was made.

This transaction had a fascinating history. A very brief summary should be enlightening. Several acres had been purchased for a lump sum over 20 years earlier. Only a small portion was put into use by the business. Another portion was contiguous to a rail spur and was sold shortly after the purchase. The major portion of the cost was allocated to the section sold. The remaining land was made up of some valueless sand dunes and the site of the business. Over the years there were several cash outlays in connection with the land. Some of these were capitalized but most were expensed. One item that had been capitalized was a relatively recent tax assessment. The magnitude of the assessment was greater than the total cost of the original purchase. Several additional parcels were sold sporadically. The original cost and the subsequent capitalized costs were apportioned to the parcels as they were sold on two different bases--square footage for the earlier, and market value for the later, sales.

Several years earlier it had become apparent that the worthless sand dunes were becoming very valuable for use as beach front resorts. Accordingly, the management had the land platted and the accountants allocated the unexpired costs between

the industrial site and the remaining beach front on the basis of the then existing market prices. They added the cost of platting to the costs previously allocated to the beach front and then apportioned the costs to each individual parcel on the basis of the then existing market. The management held the land for about five years and watched its value grow as the houses and motels built up along the beach.

When they started selling it the bookkeeper erred by expensing a parcel that had not been sold. She charged off a parcel "costing" $1,700 instead of the correct one which "cost" $1,100. The sale price was slightly in excess of $70,000. Luckily the auditor caught the error!

After the ensuing conferences the auditor commented that the amount was "immaterial" anyway. We agree, and further we object that it was also irrelevant, arbitrary and prejudicial. The $600 deviation could have been occasioned by almost any of the previous allocations or capitalizations. If they had been, they would have been acceptable to the auditor. Thus, the auditor spent many man-hours "correcting" an "error" that was much smaller than the acceptable deviations. If this function has instrumental content, it is the duty of someone to explain it.

Examples of this type could be related at length. Practically everyone knows about the vast divergence in value resulting from different accounting methods. Yet it is the auditor's sole

function to ensure that the self-selected methods are followed.[2]

The author was struck by two facts in this experience. First, the auditors were intelligent, dedicated and industrious. They were better educated, on the average, than the management they were auditing. Their high rate of recompense reflected their superior abilities. Second, at least 90 per cent of their effort was wasted. One could argue that their presence prevented management from bilking an unsuspecting community and in some cases this would be true. However, one could hope that they would perform a more useful function in addition to simply being present. Our suggestion is that they devote their time and energy to determining the relevant figures and refining the techniques of that determination.

Summary

The figures that are currently reported as "income" are irrelevant. The relevant figures are more difficult to come by, but they are infinitely more valuable. The difficulties increase as the market becomes more imperfect and result in more chance of error and less observer agreement. However, once the conceptual confusion about the temporal location of the measurement is cleared up, the problem becomes one of instrumentation and

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[2]In recent years they have denied that they are responsible for ferreting our defalcations. Employee chicanery is now discovered only incidentally to their major function of checking procedures.

observation, i.e., it is exactly like other problems in metrics.

Recognizing the similarity in problems, we can borrow from the metricians and make the measurement. The dispersion can be measured, or at least estimated, and the resulting range can be used with confidence. Perhaps the range can be narrowed as experience is gained and new techniques are devised.

This will be an expensive process. However, the current state of auditing is mostly ritual and these resources could be redirected toward the determination of the relevant figure with little, if any, additional costs.

Stable Price Level

One of the most ancient and perplexing problems in economics is caused by what Simons has called the "patent instability of the monetary numeraire." Most economists have discussed it at one time or another and the concept was cleared up long ago. Mill drew the basic distinction as early as 1849:

> There is such a thing as a general rise of price. All commodities may rise in their money price. But there cannot be a general rise of values. It is a contradiction in terms. A can rise in value by exchanging for a greater quantity of B and C; in which case these must exchange for a small quantity of A. All things cannot rise relatively to one another.[3]

This distinction is still valid. It is the difference between a change

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[3]Mill, Principles, p. 439.

in the ratio of exchange and a change in the numeraire. In concept it is the epitome of simplicity, but in application there are a number of grave problems.

The problem in its simplest terms is one of pure metrics. At any given moment in time there exists a ratio at which goods are exchanged. For convenience, all these goods are stated as a specific number of units of the monetary numeraire. By this relation to units, all the goods are related one to another. This is an instantaneous comparison which we have previously referred to as a transformation coefficient and commonly known as a price. By means of these prices a person can exchange until his utility is at a maximum.

At a different moment in time there is another series of prices which permits the same process. If the price level has been stable, i.e., if the same magnitude of money yields the same utility, the two moments are comparable and the measurements are additive. That is, the difference between the wealth--with the commodities valued at the present transcos and money at unity--will yield a meaningful difference between the level of satisfaction that is available at the two instants. However, if this relationship of money to utility changes over time, i.e., if the same magnitude of money yields a different amount of utility at two instants, the moments are not comparable and the price level is said to be unstable.

Proportional Price Changes

The simplest case is one where the ratio remains constant but the price level changes. In other words, where all the price changes are proportional in the same direction. In this situation wealth will not change when goods are held but there will be a wealth change if cash is held.

For example, suppose that there is a simple economy with only three goods. At t_1 the prices of these goods are

$1 per X

$2 per Y

$3 per Z

At t_2 the prices are doubled.

$2 per X

$4 per Y

$6 per Z

The ratio of dollars to goods has changed but the ratio of goods to goods has remained constant. At both instants the ratio of goods to goods is

$$2X = Y$$

$$3X = Z$$

$$1\text{-}1/2Y = Z$$

The only thing that has changed is the size of the unit. A similarity transformation is needed in order to make the instants comparable (additive) in dollars. That is, we need to discover a constant coefficient which will equate the two units. This is precisely

the same problem as changing, say, feet to yards or pounds to tons.

In any similarity transformation there must be some basic factor that is invariant before the coefficient of transformation can be discovered. For length this is relatively easy. The Bureau of Standards maintains a physical representation of an arbitrarily defined "foot" and another for a "yard." It is assumed that this physical representation is invariant over time.[4]

If yards changed to feet over time, however, there would have to be some third unit (which was temporally invariant) that could be used as the basic unit of comparison. That is the situation with dollars since they vary over time in relation to goods. In order to discover the similarity transformation a third unit which does not vary must be discovered. In the simplest case--

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[4]We say "assumed" to be invariant because there is no way of verifying by comparison that the physical representation has not changed. The previous moment is gone and one can never directly compare the state of anything with its state in the past. That is, one cannot align the "standard yard at t_1" with the "standard yard at t_2" because the two moments are mutually exclusive.

Of course, the Bureau of Standards maintains the standard yard under carefully controlled conditions. They assume that the conditions are constant and therefore strengthen their conclusion that the yard is constant. But note the assertion that, say, the temperature is constant is not verifiable by comparison because the two movements are mutually exclusive.

This is an infinite regression that again leads back to one's conception of the universe. It is an epistemological question that depends on the construct. We are not seriously suggesting that the yard is invariant and that all other lengths vary proportionately with it. The only purpose of this note is to point out the impossibility of verification by direct intertemporal comparisons. For

proportional changes--the price relative of any particular good may be used. The ratio of goods to goods has remained constant and therefore we could use goods as the unit assumed to be temporally invariant.

The operation is fairly straightforward.

1. Make the measurement in the extant units at both instants.
2. Discover a unit that is temporally invariant.
3. Compare the extant units at both instants to the invariant unit and express them as a ratio. This ratio is the similarity transformation.
4. Select one of the instants as a base.
5. Multiply the measurement taken at the other (non-base) instant by the similarity transformation.

This operation is general. It is applicable to all similarity transformations.

In this case the prices have doubled and the similarity transformation is obvious. It is 2 if we select t_1 as the base and 1/2 if t_2 is selected. The value of X is either \$1 or \$2 at <u>both</u>

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this reason, one can only assume that the basic unit is temporally invariant.

The problem is pertinent to our suggestion that verification is a function of observer agreement instead of direct comparison. The insistence on verification by conversion is similar. The requirement that a commodity be sold before its value can be verified is an unbearably narrow interpretation of the concept of verification.

instants depending upon the base. The value of X is constant and will remain constant so long as the price changes are proportional. Thus, there can be no gain or loss, no income, when goods are held. The change is only in the size of the unit.

However, if one holds the units--dollars--over this period, there is a change in wealth, command over goods, utility. One dollar at t_1 is exchangeable for one X and consequently one dollar is equal to whatever utility associated with one X. At t_2 one dollar will yield only one-half X and there is a consequent reduction in utility. The command over goods has been halved and the utility reduced.

Note that the effect of this assumption is to reverse the roles of money and commodities. Money is now risky and commodities are riskless. The trader can ensure a constant amount of wealth by holding wheat but the holding of money subjects him to risk. Under the assumption of a stable price level it is the change in ratios of goods which causes risk and permits gains. Under the proportional price change assumption, the change in the size of the unit causes the risk and only by holding money can there be a gain or loss.

Non-proportional Price Level Changes

The serious problems arise in the more complex case of changes in both the ratio of goods to goods and the level of prices. It is still relatively easy in concept but because of the gross errors in the literature we need to be precise in the formulation of that

concept.

The difficulties lie in the determination of the similarity transformation. Just what the invariant unit is, or should be, is not apparent. Suppose that in the three-commodity economy the prices at t_1 were

$1 per X

$2 per Y

$3 per Z

and at t_2 the prices were

$3 per X

$4 per Y

$5 per Z

The total dollars required to purchase one of each commodity has doubled. However, this does not mean that the proper similarity transformation is 2 or 1/2. It is true that $6 will buy one half of each good at t_2 but a similarity transformation of 1/2 tacitly assumes that each commodity should be weighted equally. There is no a priori reason to weight the commodities in that fashion and there are strong reasons for not doing it. Suppose for example that one was interested only in the commodity X. One dollar at t_1 is exchangeable for one X but only for one-third X at t_2. Thus, in terms of X alone, there is a similarity transformation of 3, or 1/3 if cash is held.

The situation is even more muddled if a commodity is held over the period. If the trader starts with one X at t_1 and still

holds it at t_2, he is exactly the same position in terms of X. He started with one X and ends with one X and, if X is used as the invariant unit, no change has occurred. However, in relation to Y and/or Z he is better off because of the ratio change, i.e., the price relatives of Y and Z are less than that of X. At t_1 one X was exchangeable for 1/2Y; at t_2 it is exchangeable for 3/4Y. Thus, in terms of Y he is 50 per cent better off. In terms of Z he is 80 per cent better off. In terms of X and Y equally weighted he is 65 per cent better off. In terms of all three weighted equally he is about 30 per cent better off. Here are five different figures representing the degree of "better-offness" each depending upon the particular good or combination which was selected for comparison. If weights different from unity were used there would be an infinite number of measures of better-offness since there are an infinite number of possible weights.

One possible escape from the dilemma is to project a pattern of purchases and use the goods in that pattern as the invariant unit. In terms of the example, we could project that the trader will purchase commodity X and therefore X is the pertinent invariant. This has been suggested in the literature. The arguments for "specific price-indices" are, in effect, this proposal. That is, the prices of the goods that a firm has been, and is expected to continue, purchasing are used to calculate the index.

In the trader model the "specific price index" turns out to be the price relative of wheat. Under this assumption it is

impossible to make gains or losses from holding the commodity. The relative of the prices at two instants is used as the similarity transformation and then one of the prices is either deflated or inflated. The difference between the values is always equal to zero and thus there is no possibility of either gain or loss.

For example, suppose that the price of wheat was $1 per bushel at t_1 and $2 per bushel at t_2. The specific price index is either 2 or 1/2 and the difference in the adjusted values is always zero. Moreover, note that it is true in more complex cases. No matter how many goods are held, a perfect specific price-index will always yield a difference of precisely zero. This basic fact apparently has been completely overlooked by the people who have suggested the use of specific price indices.

The "keeping physical capital intact" notion seems to be the basic assumption of those who have made the suggestion. We have previously pointed out that this assumption has the effect of shifting units in the measurement. It is equally true in the case of specific price indices regardless of the assumption behind it. That is, the specific good that the enterprise holds becomes the unit of measurement if specific indices are used.

Another effect of specific price indices is to shift the risk factor again. Commodities can have no gains or losses but money can. That is, if both commodities are adjusted by the specific index the value of money will change but the value of commodities will not.

This view may be supported by appealing to the "entity concept." Some writers argue that an enterprise is a separate and distinct "entity" with little, if any, relation to the owners, managers, creditors, etc. As we have previously emphasized, this is not our view. It seems self-evident that the enterprise exists only because people have created it and that the motivation of humans is the motive force of the enterprise. We view "enterprise" as nothing more than a convenient name for the vehicle which humans establish to maximize their utility.

For this reason, utility must be the basic referent--the invariant unit--which is used to calculate the similarity transformation. We have previously argued that, under conditions of stable prices, money is the proper valuing agent (unit of measurement) because it relates to all goods and therefore is an expression, albeit an imperfect one, of utility. Under unstable prices the unit of money is no longer invariant and therefore we must revert to the more primitive concept of utility.

The use of utility as the temporally invariant unit makes the price-index notion abundantly clear. By use of the indifference analysis one can plot the ratio of goods to goods on a utility map and observe the highest possible level of satisfaction. The same procedure can be followed for different instants and then the two amounts of money necessary to yield a constant level of satisfaction can be expressed as a ratio. This ratio is the perfect price-

index, i.e., it can be used as a similarity transformation to equate the money at both instants.[5]

Unhappily, however, there are two major obstacles in the utility analysis. First, it is not subject to empirical determination. The unit has been named (utils) and there have been scattered experiments in which attempts have been made to measure it. "Satisfactions" are in the realm of the psyche however, and we have been uniquely unsuccessful in measuring general psychic sensations. There has been some success in measuring a particular individual's sensations but these only point up the second obstacle. Second, utility is highly personal. It varies from individual to individual and thus any index derived directly from the utility analysis would be peculiar to a single person. As a general measure it would be useless. It would have no relevance to a heterogeneous group of receivers.

Both problems are well known but the first receives more attention in the literature than the second. However, the second is more pertinent to this study and deserves emphasis. A perfect price index is a purely personal concept and is applicable only to that person. Thus, changes in wealth, under conditions of unstable prices, is a purely personal measurement and any attempt to

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[5]For a more complete description see almost any basic economics text. For an excellent non-technical discussion directed toward a lay audience see William I. Greenwald, "Some General Limitations of the Consumer Price Index," Labor Law Journal, April 1956.

generalize is prone to a wide margin of error.

Statisticians have attempted to overcome the first problem by postulating patterns of purchases (market basket) as a substitute for the undeterminable utility. They have noted the second problem and have warned against the indiscriminate use of the indices. All indices that are now constructed are weighted means of an assumed market basket of goods. Some are more complex than others, e.g., geometric vice the simple arithmetic mean, and some have special features, e.g., reversibility, that others do not. Still they are basically the same: The weighted mean of the prices of selected goods. Obviously, the meaningfulness of any index varies inversely with the degree of deviation from the assumed pattern of purchases. The pattern is unlikely to fit any particular person perfectly and it may vary widely. The consumer price index includes meat and milk which has little relevance to a vegetarian or to a playboy who consumes wine, women and song.

The personal nature of these measurements, both from the utility and the pattern-of-purchases point of view, must mitigate any appeal for the use of indices. One could argue, with some merit, that each man should be his own metrician. Each man should construct his own index and make his own calculation of wealth changes. For the contrary, one could argue that few people are likely to have the past records, knowledge, time, and

facilities necessary to make the calculation.

One conclusion, however, is inescapable. The current market price is the only number which relates all the extant alternatives. Any tinkering with that price will destroy that relationship. The present price is an instantaneous measure of goods in their relation to other goods. The attempt to make an inter-temporal comparison should not be done at the expense of destroying the instantaneous comparison. Further, it is almost axiomatic that people have a wider range of knowledge about present prices than they do about past prices. If they need to know the price of a particular alternative, the present price is usually much easier to obtain than the past price. (This is not surprising, it is mute testimony to the irrelevancy of past prices.) For these reasons, any adjustment should be to past prices and the present prices should be reported unadjusted.

Any attempt, therefore, to make the dollars intertemporally comparable must utilize the present instant as the base and inflate (deflate) the previous valuations. With this primary conclusion understood we will argue that index numbers should be constructed. Our reasons follow.

First, it is unlikely that the receivers will construct their own personal index and thus the choice is between an imperfect general index and no index. In the absence of any index the units are clearly not comparable; they are not additive and thus the difference in wealth is erroneous. Use of a general index will not

eliminate these errors but the degree will be lessened.

Second, the adjustment of past prices means that the present prices will be reported at each information date. Hence, both time series--the adjusted and the unadjusted--will have been presented to the receivers. Each receiver can then calculate his own index if that is what is desired. Regardless of the individual index, the presentation of both series has more informational content than either alone.

Third, our institutional structure make certain obligations dependent upon income. If the wealth change is due solely to inflation in some cases and not in other cases, unadjusted figures will cause inequities. An imperfect index will reduce these inequities even if it does not eliminate them.

Fourth, the index is a useful conceptual tool. It is a generalization that admittedly does not fit any specific case but it, like other generalizations, organizes the data in a comprehensible fashion. The individual prices are too complex to be comprehended in the absence of an index.

For these reasons we conclude that the data should be adjusted. In view of the second point it does not appear that it could do any harm, it has no negative aspects, and there are several sound reasons in its favor.

The only problem left is the selection of the index. In view of the motivation of the enterprise it should be obvious that the Consumer Price Index is most appropriate. It is the closest

substitute for a utility measurement that is currently available. In addition, it is a more general concept of purchasing power than any of the competing indices. We say "more general" because the Consumer Price Index includes only final goods. The other indices which are often described as general, e.g., the implicit GNP deflator, are heavily weighted with intermediate goods. Intermediate goods should be excluded from the purchasing power concept because they are only indirectly productive of utility. That is, they produce utility by producing the final goods or by being exchanged for consumer goods. The only direct connection with utility is their sale price at the present moment which yields a command over goods. However, this command over goods is given by the present market price at each instant; the ultimate purpose of an intermediate good is to garner command over final goods and thus only final goods should be used in the construction of the index.[6]

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[6]This point has been given rather short shrift here because it is so well understood in the economics literature. Smith's famous statement that "Consumption is sole end and purpose of production..." (Wealth of Nations, p. 265) set the stage. Mill's distinction between price and value is cut from the same cloth. Walras touches on it. (Elements, p. 317.) Marshall, as usual the synthesizer and clarifier, leaves no room for doubt. "The general purchasing power of money should properly be measured by reference to the retail prices paid by the ultimate consumers of finished goods." (Alfred Marshall, Money, Credit and Commerce, London: 1923, p. 32.)

Later, Keynes wrote the following:

> We mean by the Purchasing Power of Money the power of money to buy the goods and services on

Application of the index is not difficult. The previous valuation(s) should be multiplies by the index number either singularly by commodity or in toto. The previous valuation(s) are readily available from the last report and the Consumer Price Index is regularly published. Thus, there are no practical problems of application. In order to be perfectly clear on the meaning of the figures we will state them formally.

Let

$P_1(t_j)$ = price of wheat at j^{th} instant.

$P_j(t_j)$ = price of the j^{th} commodity in the set of all commodities at the j^{th} instant. The set has n elements.

$C_j(t_j)$ = price of the j^{th} commodity in the subset of consumer goods at the j^{th} instant. The subset has m elements.

$Q_1(t_j)$ = quantity of wheat held by the trader at the j^{th} instant.

$M_1(t_j)$ = quantity of money held by the trader at the j^{th} instant.

Q_j = quantity of the j^{th} commodity.

K = the constant weight in the market basket of consumer goods.

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the purchase of which for purposes of consumption a given community of individuals expend their money income. (John M. Keynes, A Treatise on Money, London: Macmillan, 1930, Vol. 1, p. 54.)

After the syntax is straightened out, one finds that Keynes was saying exactly the same thing as Marshall.

The consumer price index is defined as

$$I = \frac{\sum_{j=1}^{m} C_j(t_2)K_j}{\sum_{j=1}^{m} C_j(t_1)K_j} \qquad \text{(eq. 1)}$$

and the total value of the enterprise at t_1 is

$$V(t_1) = M_1(t_1) + P_1(t_1)Q_1(t_1) \qquad \text{(eq. 2)}$$

$V(t_1)$ is a general statement of the quantity of <u>any</u> good, or combination of goods, that the trader can command at t_1. This command over goods can also be stated as an equation.

$$V(t_1) = \sum_{j=1}^{n} P_j(t_1)Q_j \qquad \text{(eq. 3)}$$

$V(t_1)$ is given by equation 2 and P_j is given by the market. By solving for Q_j the quantity of any good or any combination of goods that $V(t_1)$ commands can be determined. It can then be adjusted by multiplying by the index number.

$$V'(t_1) = V(t_1)\, I \qquad \text{(eq. 4)}$$

The effect of the adjustment is to restrict the use of $V(t_1)$ to a description of the quantity of consumer goods that the trader can command in t_2 prices. This may be stated as

$$V'(t_1) = \sum_{j=1}^{m} C_j(t_2)Q_j \qquad \text{(eq. 5)}$$

That is, $V'(t_1)$ could be used to purchase Q quantity of consumer goods at t_2 in t_2 prices. Thus, $V'(t_1)$ is an expression of the command over consumer goods that the trader had at t_1 in terms of t_2 prices.

The value of the enterprise at t_2 can be obtained by the same operation as equation 2.

$$V(t_2) = M_1(t_2) + P_1(t_2)Q_1(t_2) \qquad \text{(eq. 6)}$$

Likewise, $V(t_2)$ may be stated as a command over all goods in the same fashion as equation 3. If desired the command over goods may be restricted to the subset of consumer goods.

$$V(t_2) = \sum_{j=1}^{m} C_j(t_2)Q_j \qquad \text{(eq. 7)}$$

The advantage of such a restriction is that it makes equation 5 and equation 6 comparable. The coefficients of both equations are identical.

$$\sum_{j=1}^{m} C_j(t_2)Q_j - \sum_{j=1}^{m} C_j(t_2)Q_j = \sum_{j=1}^{m} C_j(t_2)\Delta Q_j \qquad \text{(eq. 8)}$$

ΔQ_j is the difference in the quantity of consumer goods that the trader commands at the two instants.

The difference can be taken more directly.

$$V(t_2) - V'(t_1) = D$$

D is an expression of the difference in command over goods.

$$D = \sum_{j=1}^{m} C_j(t_2) \Delta Q_j$$

The point is that the market basket of consumer goods has become the invariant unit. The trader could command a certain quantity at t_1 and another quantity at t_2. The difference in the command over consumer goods varies directly with the utility and is taken to be an appropriate measurement of the change in wealth.

Other Valuation Methods

Relaxing the stable price level assumption strengthens the case against the other methods of valuation. Under the Fisher Tradition one would need to project the future price index as well as the future revenue in order to discount comparable figures. This is even a more herculean task than the original. Boulding's Constant is by definition not concerned with the present price of the particular commodity and thus it is reasonable to assume that it would not be concerned with the price changes of other commodities, i.e., the price index.

The amount of accounting literature devoted to the price index problem is second only to that devoted to uniformity of principles. There is a plethora of argument and analysis but unfortunately it is concerned almost exclusively with adjusting historical costs. No attempt will be made at a comprehensive review.

Instead, we will classify the arguments and briefly discuss them. (These classifications are not necessarily mutually exclusive.)

1. Those opposed to the adjustments for two reasons.
   (a) Income is now being properly measured in historical costs and therefore, no adjustment is called for.[7]
   (b) The price indices are too crude and arbitrary to be used.[8]
2. Those in favor of price level adjustments but differ as to
   (a) Selection of the kind of index, i.e., general or specific.[9]
   (b) Method of application of the index.

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[7]See, e.g., Littleton, Structure.

[8]See, e.g., Raymond Dein, "Price Level Adjustments, Fetish in Accounting," Accounting Review, XXX (January 1955).

[9]A. L. Bell ("Fixed Assets and Current Costs" Accounting Review, January 1953) states the problem exclusively in terms of the selection of the index. It seems clear that he was making the proportional change assumption because he thought that the price level adjustment was an appropriate substitute for the present market value. G. H. Warner ("Depreciation on a Current Basis," Accounting Review, October 1954) also appears to make this assumption. He thinks that either present market value or price level adjustments would be appropriate, but not both.

Some of the arguments in favor of one kind of index over the other are a little amusing. For example, R. C. Jones (Case Studies of Four Companies, Columbus, Ohio, American Accounting Association, 1955, p. 3) defends the C P I because "it fluctuates less than any other currently available general index and therefore produces smaller and less erratic adjustments for price level changes." Just why the degree of fluctuation is a criterion of selection is not clear.

We have previously concluded that income was not properly measured in the Accounting Tradition. Although we can sympathize with the crudeness argument, we also reject it on grounds that a times series is useful for general purposes.

Most accountants now have recanted on the specific index proposal presumably because they discovered that the most specific index is a price relative that leads them to current prices.[10] The original suggestions were for the adjustments to be made without recognizing the change as income. The problem was stated as one of matching current costs against current revenue. The results should be obvious: no income would ever be recognized. That is, the inflation of the historical costs by the price relative yields the same magnitude as the sales price. When they are matched the difference (income) is always zero. This again is a switch in the valuing agent from cash to the commodity. It usually goes under the heading of "keeping physical capital intact" versus "keeping monetary capital intact." By keeping physical capital intact, the command over goods can go to infinity without one

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10"Its [general index] weakness is in the fact that over-all purchasing power of the dollar is not a meaningful concept to most individuals or business firms....The price of any commodity or the average of the prices of any group of commodities may move at a markedly different rate, or even in a different direction, from the average of all prices....However, if we think of adjusting historical costs for changes in the purchasing power of money as measured by those prices specific to the operations of the individual firm, we find that we have again entered the realm of current cost, but by a new avenue."
(Hill & Gordon, pp. 238-39.)

cent of income ever being recognized.

The more recent work has recommended that a general price index be applied to the historical cost figures. Both the American Accounting Association and the A I C P A have made studies that reach this conclusion. For example in adjusting the land account Mr. Mason writes:

> Land.--The land was acquired in 1932 when the price-level index was 58.4 or the purchasing power 1.954 times that of December, 1952. In order to express its cost in terms of the December, 1952 dollars, this calculation is made:
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> $12,000 x 1.954 = $23,400[11]

More recently the Research Staff of the A I C P A has recommended the same procedure. They write:

> At this point a summary statement is given to provide prospective. With respect to "invested costs" or "nonmonetary items" (e.g., assets that are not in the form of money or claims to money), and with all technical details aside, the dollar amounts ascribed to the item at one point of time may be restated in terms of the dollar at any other point in time.[12]

Their example is provided by "land, at cost of $1,000" held through a period when the "general price-level index rises from 100 to 200." The land is then stated in end of period prices by multiplying

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[11]Perry Mason, Price-Level Changes and Financial Statement (American Accounting Association, 1956), p. 20.

[12]Research Staff, American Institute of Certified Public Accountants (New York: American Institute of Certified Public Accountants, 1963), p. 10.

$1,000 times 200 and valuing it on the balance sheet at $2,000.

The resulting figure of $23,400 or $2,000 is an enigma. It is difficult to state exactly what it means. For example, does the $2,000 represent the amount of goods (or dollars) that would have to be sacrificed now in order to obtain the land? No, not unless the price changes were proportional. Does the $2,000 represent the amount that could be received if sold? No, not unless the changes were proportional. Does it represent the intended-use value, the discounted returns? No, not unless the future revenue is expected to change proportionately.

The figure, at best, represents the current amount of goods that would have to be sacrificed in order to acquire the asset at some previous exchange ratio. That is, there is an implicit denial of the importance of price changes but a recognition of the need to adjust for price-level changes. The resulting figure has the same effect as the proportional price change assumption. The assumption is not made but the results are recognized.

> The result is consistent with a common sense interpretation--an invested cost of 1,000 "date-of-acquisition" dollars is restated as the equivalent of 2,000 "end-of-period" dollars, with no gain or loss recorded, while cash held through a doubling of the price level loses half its value, or $1,000 measured in "end-of-period" dollars.[13]

Cash has become the risky asset with the loss being recorded but

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[13] Ibid., p. 12.

the commodity is simply restated without gain, hence it has become riskless. This is true at least until the commodity is sold at which time the gain or loss due to the transco change is "realized."

We see no valid reason for this action. The price-level changes are important but no more so than the ratio changes. There are two significant variables in non-proportional price changes. There is no valid reason for ignoring one of those variables.

Summary

Instability of the price level is defined as a change in the size of the unit. In order to determine the magnitude of the similarity transformation for the units, there must be an invariant referent. Such a referent is found in the concept of utility. Thus, the similarity transformation--the price index--is the ratio of two amounts of money that will yield the same utility.

The concept is clear. The basic purpose is to discover how much "better off" a person is who holds money or monetary claims at two points in time. It is an intertemporal problem of the change in wealth and as such it is vital to the concept of income.

In application of the concept there are two main problems. First, utility is not subject to empirical determination, and second, utility is highly personal and varies from person to person.

Patterns of purchases have been postulated as a substitute for the utility measure and assumed to be invariant in utility. This is a generalization that is not perfectly applicable to any particular case. The degree of applicability varies inversely with the degree of deviation from the postulated pattern of purchases.

These two problems, and particularly the second, must mitigate any conclusions about the use of index numbers. In view of the criterion of relevance, however, it is imperative that the present prices be presented and the adjustments be made to the past valuations. This procedure will leave the information content of the latest report intact. Further, it will allow each individual to calculate his personal price index if he has the ability and desire.

In spite of these serious problems, an index-adjusted time series is a desideratum. As a generalization it is conceptually useful although its limitations are rather severe. The decision presents us with the problem of postulating a pattern of purchases, i.e., selecting an index.

In light of our earlier observations on the chain of motivation for the enterprise, we conclude that the consumers' price index is appropriate. Admittedly, this is not a perfect index, but it is superior to its competitors. The other general indices include intermediate goods and their use requires some rather odd assumptions about the nature of the enterprise's motivation. The

use of specific indices reverts to the replacement cost argument and shifts the valuing agent from money to the specific commodity. In short, the alternatives lead to absurdity and this strengthens our conclusion that the consumer price index is appropriate.

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Robert Raymond Sterling was born May 19, 1931, at McAlester, Oklahoma. In 1944, he was graduated from McAlester High School. In August 1956, he received the degree of Bachelor of Science from the University of Denver. In August 1958, he received the Master of Business Administration from the same university. In September 1959, he enrolled in the Graduate School of the University of Florida. From that time until the present, he has pursued his work toward the degree of Doctor of Philosophy.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Business Administration and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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3202